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THOMAS A. TRUMBOUR
Business Manager

DR. WALTER R. MEYER
Managing Editor

PALMER H. LANGDON
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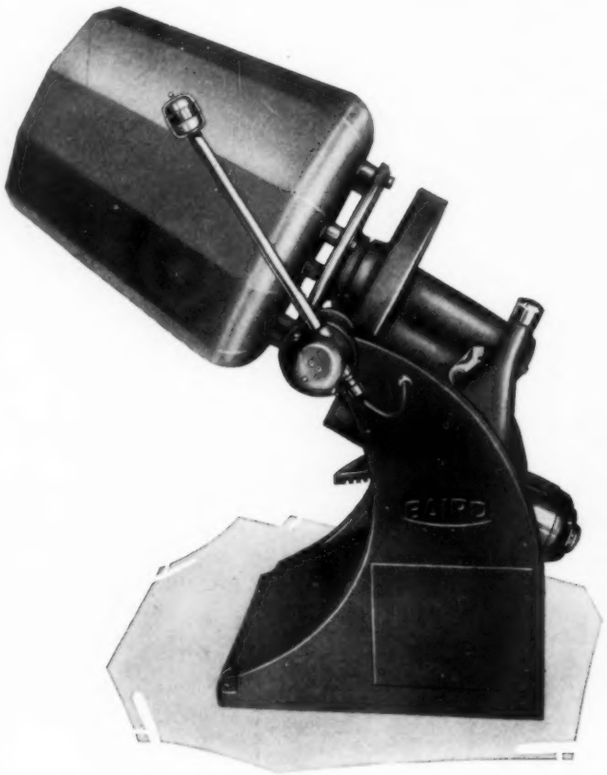
AUTOMATIC TILTING DEVICES
BAIRD TUMBLERS



This shows the side of a No. 1 BAIRD Model B. Single Oblique Tilting Tumbler with a No. 22 Sheet Steel Polygonal Barrel and with an Automatic Electrical Tilting Device.

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METAL INDUSTRY
FABRICATION · ASSEMBLING · PLATING · FINISHING
VOL. 37, NO. 4 APRIL, 1939

The Annual Convention of the American Electro-Platers' Society

FACTORY superintendents, works managers and factory owners who have plating and finishing departments should consider within the next few weeks the possibility of sending their plating supervisors to the annual convention of the American Electro-Platers' Society, to be held at Asbury Park, N. J., June 19-22 inclusive under the auspices of the Newark branch.

The outstanding developments of the year will be presented in 27 papers (see page 193) prepared by the leading authorities of the United States and Europe. The papers are not pre-printed and are read for the first time at the educational sessions which frequently run far into the night. The discussions of the papers are frequently extensive and often present valuable information in addition to that contained in the text of the papers.

The highly technical nature of plating and finishing processes requires continuous study of the new developments by the plating supervisor to insure the use of the most modern, trouble-free and economical procedures. Month after month, these plating supervisors study chemistry and methods of analysis, listen to lectures and read the technical literature pertaining to their industry. The annual convention is the climax of this rigorous routine of endeavor—the sine qua non to the maintenance of high quality plating and finishing.

The informal talks with the leading men of the industry, exchanges of information and ideas with fellow practical men, and the new acquaintanceships made, from whom future advice may be sought, all should result and have resulted in intrinsic savings which far transcend the monetary expense or the time spent at these conventions.

The educational sessions are judiciously balanced by social activities—Monday night get-together sponsored by the International Fellowship Club—trips through factory plating plants—the Thursday night dinner and dance.

This year's meeting of the American Electro-Platers' Society has the added significance of being the Second International Conference on Electroplating with papers by authors from England, France and Canada as well as from the United States.

Factory Managers and Superintendents—we believe that you will make a tangible investment by sending your plating and finishing supervisors to the A.E.S. Convention at Asbury Park. Your decision to do so will partly repay your supervisors for their unceasing efforts to increase their knowledge and the quality of their work, and will enable them to attack new problems with the help of the latest knowledge in plating and finishing.

Recovery of Gold and Silver From Plating Solutions

By Frank K. Savage

Electrochemical Engineer,
C. G. Conn, Ltd., Elkhart, Ind.

Simple, effective methods of recovering silver and gold from their respective plating solutions are described. The silver is precipitated by zinc borings and turnings in compartments of a baffled tank and the gold is recovered by a plating process.—Ed.

Introduction

In every plating plant where large quantities of precious metals are corroded, there are innumerable possibilities for leaks and subsequent large losses due to the manner of handling the work and the solutions.

Due to the arrangement of the plating room and the method of handling the work, an elaborate system of drag-out tanks and a counter flow system to prevent concentration in the drag-out tanks seemed not only expensive to install and operate, but were undesirable from the standpoint of floor space. To prevent a high precious metal loss from drag-out, the following procedures were put into operation at C. G. Conn, Ltd., for the salvage of gold and silver.

Method of Recovering Silver

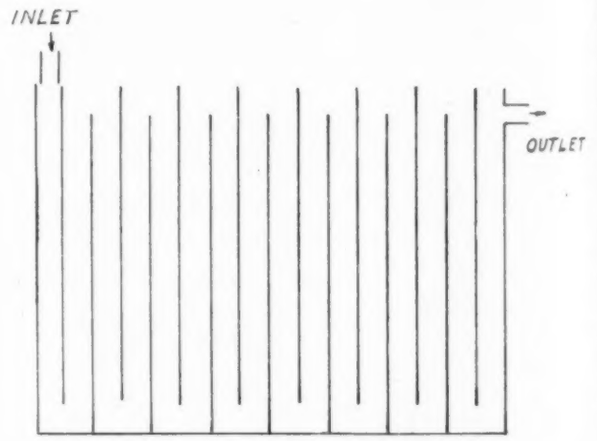
The fact that silver deposits on zinc by simple immersion due to their wide difference in the electromotive series was used in recovering silver from rinse water. All of the silver plated instruments are rinsed in one of two rinse tanks which drain into the recovery tank. The recovery tank was constructed with glass baffles so that the rinse water had to travel some twenty-five feet through the system before draining into the sewer. The space between the baffles is kept filled with close-packed zinc borings and turnings. The zinc is held in place at each end by excelsior which prevents its washing out.

It has been found that the tank if regenerated with fresh zinc occasionally, removes much if not practically all of the silver from the solution introduced through drag-out. The zinc chips should be fine, free from grease, oil or other contamination. The precipitated silver, residual zinc, and dirt accumulation in the tank are periodically sent to a silver refiner for recovery.

This method effects a decided savings in floor space over a drag-out or concentration tank system, particularly if the counter flow principal is used. Also, it very often happens that the metal concentration in a drag-out tank is allowed to build up so high that the loss from it by drag-out cuts the metal recovered to a fraction of the total amount lost from the plating tank. This is particularly true if a large amount of work is being processed in a cold solution such as silver and the operator merely depends upon the making up of the evaporation of the plating tank from the drag-out tank without concentration, whereas if reasonable care is exercised by the operator to regenerate the baffled precipitation tank with zinc occasionally, its efficiency will not drop off to such an extent.

Method of Recovering Gold

Gold is recovered from drag-out by a very simple arrangement. Work from the various gold solutions is rinsed thoroughly in a tank where the free sodium cyanide concentration is held between ¼ and ½ oz./gal. On one side of the tank, there are several carbon anodes and on the other side, brass cathodes. The six-volt bus bar potential is impressed upon the tank electrodes whenever the generator is running. The gold drag-in from the work is plated on the brass cathodes. The cathodes are equipped with cloth bags to hold any gold that drops off after deposition. Periodically the cathodes are removed, the bags burned, the brass dissolved in nitric acid, and the gold purified by solution in aqua regia and precipitation with ammonia. The fulminate of gold is added back to the plating solutions. Considerable quantity of gold is recovered yearly in this way without the necessity of a great deal of space taken up by a system of drag-out tanks and concentration tanks.



Baffled Tank for Silver Recovery.

A Study of the Alkaline Tin Plating Bath

By Samuel Heiman and Walter W. Lucasse

Dept. of Chemistry and Chemical Engineering, University of Pennsylvania, Philadelphia, Pa.

The authors have studied the effects of variations in sodium stannate and sodium hydroxide concentrations and temperature on the practical operating characteristics of the alkaline tin plating bath.—Ed.

Introduction

Tin may be deposited satisfactorily from a sodium stannate solution over a wide range of conditions of temperature, current density and stannate concentration. In contrast to the acid tin bath, no addition agents are necessary to produce excellent coatings. However, even a very small proportion of bivalent tin in the solution is sufficient to cause the production of dark or spongy deposits. With tin anodes operating under normal conditions, the metal enters the solution as bivalent tin, thereby causing deterioration of the deposit. A number of methods for overcoming this defect of the bath have been developed and initially consisted in providing conditions that would insure rapid oxidation of any stannite to stannate. Thus, Proctor[1] described a stannate bath containing sodium perborate or hydrogen peroxide, while Oplinger[2] later suggested a similar solution and amplified the information needed for controlling the bath. Hothersall, Clarke and Macnaughtan[3] proposed another method which consisted in the use of insoluble anodes. This method, however, had the serious disadvantage of involving the depletion of the tin content of the bath.

In 1935, a great step forward was made when Haensel and Gravel[4] showed that under certain conditions at the anode it was possible to insure that the tin will dissolve entirely in the quadrivalent form, i.e., as stannate. They found that while at a relatively low anode current density, tin dissolves as stannite, upon progressively increasing the anode current density, a critical value is ultimately reached at which there is a sharp rise in the voltage (anode potential) and the formation of a yellow-green film on the anode. It is the presence of this film that insures that the tin dissolves entirely in the quadrivalent state. Once this film has formed on the anode, the tin will continue to dissolve as stannate even though the anode current density is lowered below the critical value. These results were confirmed by Macnaughtan, Tait and Baier[5] and by Stout and Baum[6] who extended their work to more concentrated solutions. Only very recently, Baier and Angles[7] have made a very complete report of their work on the stannate bath.

One of the chief objectives of the present study was to determine the effect of such variables as stannate and sodium hydroxide concentration and temperature on the practical operating characteristics of the alkaline tin plating bath when the anodes were polarized under conditions described by Haensel, and to establish the optimum operating conditions and solution composition for the stannate bath.

Experimental Procedure

The compositions of the solutions studied are given in Table I.

One liter of the stannate plating solution in a one and a half liter beaker was heated to the desired temperature on a hot plate and maintained within 2°C of this temperature by regulating the gas supply. In the anode efficiency tests, the tin anode which consisted of a stick of C.P. metal three-eighth inches in diameter, was placed vertically in the center of the beaker, while the sheet steel cathode lined the entire wall. This arrangement insured a uniform distribution and an accurate calculation of the anode current density. Special precaution was taken to produce the yellow-green film on the

TABLE I

COMPOSITIONS OF SOLUTIONS STUDIED

Bath	Sodium Stannate (Technical) oz./gal.	Sodium Hydroxide (C.P.) oz./gal.	Sodium Acetate (C.P.) oz./gal.	Variable
A	15.7	2.0	none	Reference Bath
B	15.7	none	none	No sodium hydroxide
C	24.0	2.0	none	Higher stannate
D	15.7	2.0	2.0	Plus sodium acetate
E	15.7	1.0	2.0	Lower sodium hydroxide plus sodium acetate.
F	15.7	6.0	2.0	Higher sodium hydroxide plus sodium acetate.

anode before the determination of the anode efficiency. To do this, the anode current was quickly raised to a value slightly above the critical and after being held at this point for about ten seconds was decreased to the current density at which the test was to be carried out. Then without altering the circuit, the anode was removed from the bath, rinsed, dried and weighed. It was then replaced but this time with a coulometer in the circuit. The cathode efficiency tests were carried out in the usual manner. The 1" x 3½" steel cathodes were placed in the center of the beaker with the tin anodes on both sides against the walls of the beaker. In determining the critical anode current densities, the voltage was increased in small increments and allowed to come to equilibrium at each current density.

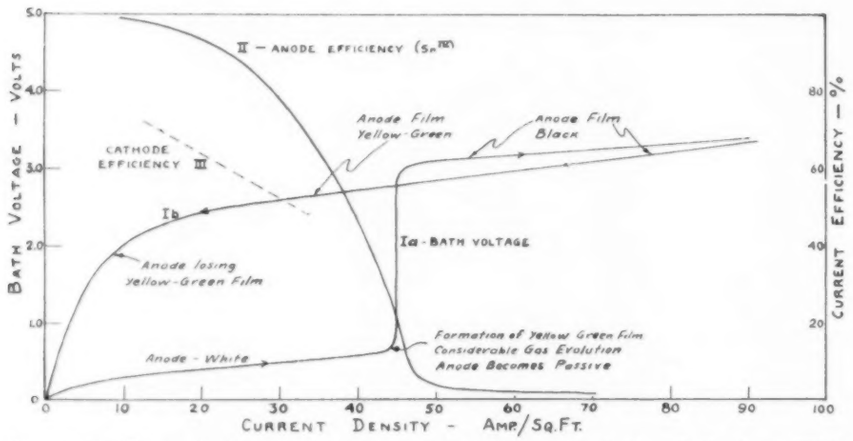


Figure 1. General characteristics of a typical stannate bath. Bath A at 75°C.

Discussion of Results

GENERAL CHARACTERISTICS OF A TYPICAL STANNATE BATH

The general behavior of the reference bath A at 75°C is shown in Figure 1.

Along the early part of the curve Ia showing the anode current density vs. bath voltage, the tin is dissolving at practically one hundred percent efficiency as bivalent tin. At the critical anode current density of 45 amperes per square foot, the formation of the yellow-green film is accompanied by a considerable evolution of gas as the anode becomes passive and the anode efficiency falls practically to zero. On increasing the current density still more, the anode film darkens and finally turns black, while the anode efficiency remains practically zero. As the current density is reduced below the critical value (curve Ib), and the anode begins to dissolve as quadrivalent tin, the anode efficiency increases sharply (Curve II) until finally at about 10 amps./ft.² the film breaks down and the tin goes into solution as bivalent tin. It is seen, therefore, that the filmed anode dissolves as stannate tin only in the current density range between 10 amps/ft.² and 45 amps/ft.².

The anode efficiency curve for the filmed anode indicates how sharply the anode efficiency falls off with increased current density until it becomes entirely passive at about 45 amps/ft². The cathode efficiency (Curve III) also decreases rapidly with increasing current density.

The sharp increase in the bath voltage at the critical current density is undoubtedly due to the resistance of the yellow-green film which forms at that point. Baier and Angles[3] believe that this yellow-green film is probably a hydrated stannic oxide which is soluble in sodium hydroxide. It is interesting to note that excessive polarization at the anode does not occur even at a current density of 250 amps/ft.². The slope of curve Ia (Fig. 1) is practically the same above and below the critical current density. This would indicate that the resistance of the anode film remains substantially constant. Furthermore, it is seen that whereas the yellow-green film is soluble in the solution, the black film is insoluble. These facts would seem to show that both the color change and the decrease in the solubility of the film is probably associated with a change in the film structure or composition and is not necessarily due to a thickening of the film.

Critical Anode Current Density

The critical anode current density is the minimum current density which will cause the formation of the yellow-green anodic film. The formation of this film is accompanied by a sharp rise in the bath voltage and a considerable evolution of gas. Indeed, in practice, these phenomena may serve as visible indications that the film is forming on the anode.

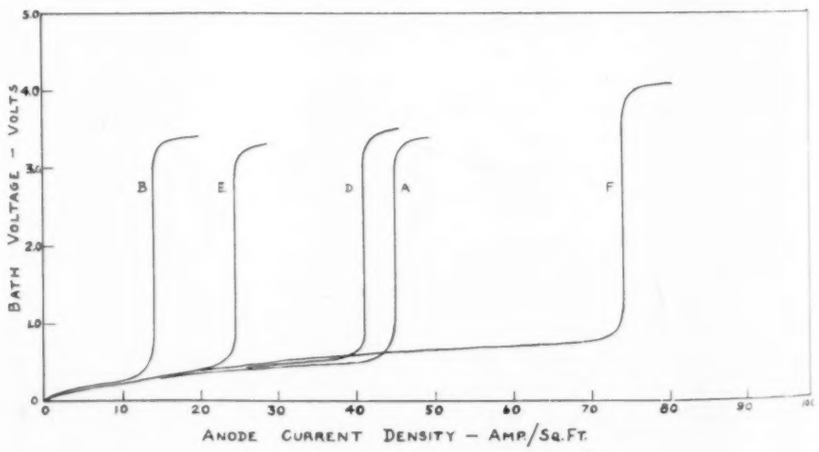


FIGURE 2.

Bath voltage vs. anode current density curves showing the effect of free sodium hydroxide concentration on the critical anode current density. Letters refer to bath compositions given in Table 1. Temperature = 65°C.

Haensel[4] found that the critical anode current density increases with temperature, with free sodium hydroxide concentration and with stannate concen-

tration. Baier and Angles[7] confirmed these results and also showed that the critical current density is reduced by the presence of sodium carbonate which is formed by the reaction of free sodium hydroxide with the carbon dioxide of the air. Furthermore, the value of the critical anode current density obtained for a given bath will also depend on experimental methods employed. For example, the rate at which the anode current density is increased and the distribution of the current density on the anode will undoubtedly affect the value obtained. The experimental procedure and th conditions of the test must be carefully defined in order to attach any significance to these values.

The marked effect of the free sodium hydroxide on the critical anode current density is shown in Figure 2. At a constant stannate concentration of 15.7 oz./gal., at 65°C the addition of one ounce per gallon of free sodium hydroxide serves to increase the critical current density by about 10 amps/ft.^{2} The presence of sodium acetate slightly decreases the critical current density.

Referring to Figures 1 and 2, one could conclude that the anode becomes passive above the critical current density, and therefore, below the critical current density the anode efficiency would increase rapidly to a high value. One might further conclude that the higher the critical current density, the higher the practical anode current density which may be used at a high efficiency. The complete data, however, show that these conclusions are true only at a bath temperature of 75°C or at a free sodium hydroxide concentration of about 2 oz./gal. as shown in Fig. 3. At a temperature of 65°C or in a bath of high free sodium hydroxide content, the anode becomes passive at a much lower current density than the critical value. For example, in Fig. 3 the arrow shows that the critical current density of bath C at 65°C is 38.4 amps/ft.^{2} yet the anode in the bath becomes passive at about 23 amps/ft.^{2} On the other hand, for the same bath at 75°C the critical current density corresponds closely to the current density at which the anode efficiency drops to zero. Other similar examples to support the above conclusions may be cited from Figs. 4 and 5. In any case, our data indicate that the anode always becomes passive at or below the critical anode current density and never above this value.

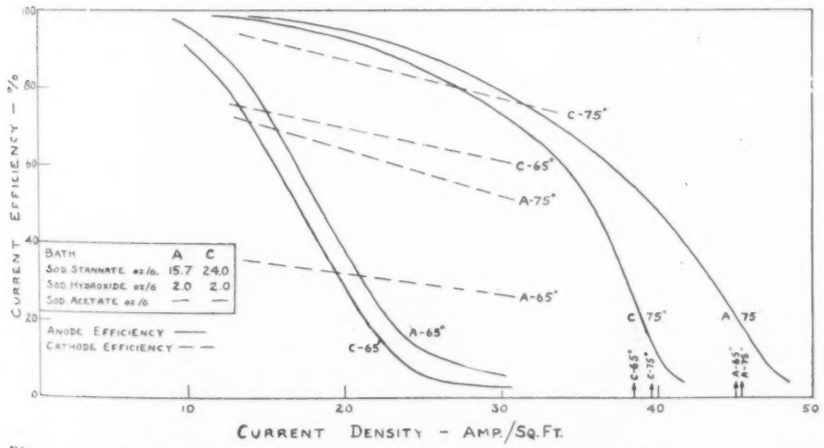


Figure 3. The effect of sodium stannate concentration on the anode and cathode efficiencies. Letters refer to bath compositions given in Table 1. Numbers refer to bath temperatures in degrees centigrade.

The Effect of Temperature and Sodium Stannate Concentration on the Anode and Cathode Efficiencies

Curves showing the effect of temperature and sodium stannate concentration on the anode and cathode efficiencies are given in Fig. 3.

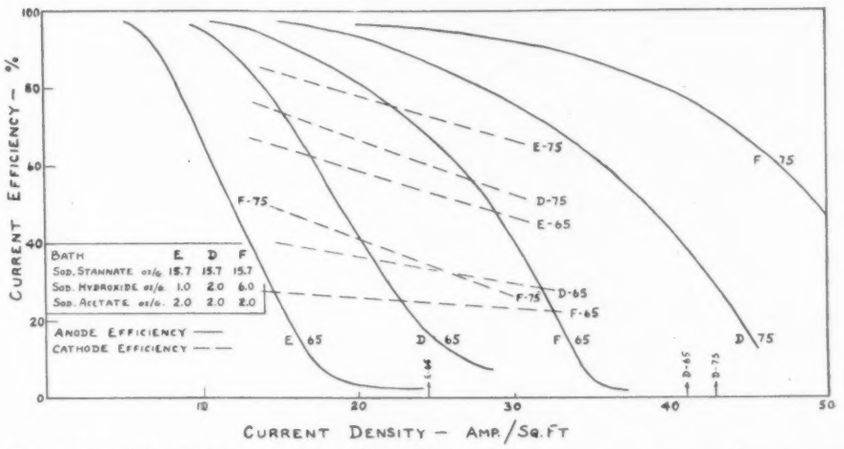


Figure 4. The effect of free sodium hydroxide concentration on the current efficiencies. Letters refer to bath compositions given in Table 1. Numbers refer to bath temperatures in degrees centigrade.

Increasing the sodium stannate content of a bath from 15.7 to 24 oz./gal. decreased the anode efficiency slightly but appreciably increased the cathode efficiency. Increasing the temperature from 65°C to 75°C for solutions containing either 15.7 or 24 oz./gal. sodium stannate greatly increased both the anode and cathode efficiencies and widened the current density range over which these high efficiencies may be obtained. The advisability of operating the bath at 75°C rather than at 65°C is evident from these data, although operation at a still higher temperature might be inadvisable owing to the more rapid formation of carbonate from the free sodium hydroxide and the increased sludging tendency of the sodium stannate. It is possible, therefore, from an inspection of these curves to choose the conditions at which the anode and cathode efficiencies will be both high and substantially equal. Operating bath C at 75°C between 10 and 30 amps/ft.^{2} at the anode and the cathode represents the optimum conditions revealed as a result of the study.

The Effect of Free Sodium Hydroxide Concentration on the Current Efficiencies

The data illustrating the effect of variation in the free sodium hydroxide content have been plotted in Fig. 4. (The free sodium hydroxide content may be determined by titrating 5 cc. of the tin plating solution with 0.1 N hydrochloric acid in the presence of thymolphthalein indicator and 50 cc. of 10% barium chloride solution[3].)

It will be seen that increasing the free sodium hydroxide content of a bath containing the 15.7 oz./gal. sodium stannate and 2 oz./gal. sodium acetate from 1 oz./gal. to 6 oz./gal. both increased the anode efficiency and extended the current density range over which the anode dissolved as quadrivalent tin before becoming passive, but decreased the cathode efficiency. In striking a balance between these two opposing effects, it is evident from an inspection of the curves that the optimum amount of free sodium hydroxide is 2 oz./gal. (Bath D). With this concentration of sodium hydroxide, it is possible to work at high anode and cathode efficiencies although in the restricted range between 10 and 30 amps/ft.^{2} The great improvement obtained by raising the temperature of the bath from 65°C to 75°C is strikingly brought out in this graph and confirms the effect of temperature discussed above.

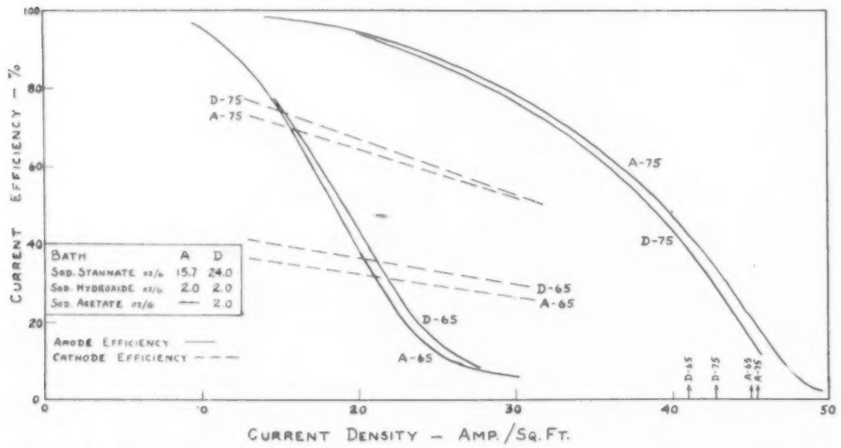


Figure 5. The effect of sodium acetate on the current efficiencies. Letters refer to bath compositions given in Table 1. Numbers refer to bath temperatures in degrees centigrade.

The Effect of Sodium Acetate on the Current Efficiencies and the Critical Anode Current Density

The concentration of free sodium hydroxide in the stannate bath is an important factor not only from the standpoint of its effect on the anode and cathode efficiencies and critical anode current density, as pointed out above, but also as regards the appearance of the deposits. Oplinger[2] has recommended the addition of acetic acid to neutralize an excess of sodium hydroxide in the bath if this becomes necessary. This will involve the accumulation of sodium acetate in the solution.

Tests were made to determine the effect of sodium acetate in a bath containing 15.7 oz./gal. of stannate and 2 oz./gal. of free sodium hydroxide, and these results are plotted in Fig. 5.

It is evident from the graph that 2 oz./gal. of sodium acetate in the bath has practically no effect on either the anode or cathode efficiencies or the critical anode current density. Since the sodium acetate is entirely inert in the bath, there seems to be no reason why it should be added.

An excess of free sodium hydroxide may be reduced not only by neutralizing with acetic acid but also by operating the bath with the anode efficiency higher than the cathode efficiency. On the other hand, the caustic soda content will build up when the anode efficiency falls below the cathode efficiency. However, barring the effects of drag-out and carbonate formation, the free sodium hydroxide content of a bath will remain constant if the anode and cathode efficiencies are maintained equal to each other.

Summary

On the basis of the present study, the following bath composition is recommended for practical operation with filmed anodes.

Sodium stannate	24.0 oz./gal.
Sodium hydroxide	2.0 oz./gal.
Operating temperature.	75°C.

At an anode and cathode current density of 25 amps/ft.^{2}, the current efficiencies are both equal to about 80 per cent. Furthermore, the bath may be operated satisfactorily over the current density range from 15 amps/ft.^{2} to 30 amps/ft.^{2} using anode and cathode areas which are substantially equal. From the above bath, at the conditions stated, excellent white deposits are obtained.

The recent publication of the very excellent and complete paper on the stannate bath by Baier and Angles[7] anticipated much of our work. This paper, has, therefore, been limited to a discussion of the specific data which the writers believe will supplement the contribution of the above-mentioned authors. Furthermore, it is our hope to obtain information on the nature of the anode film by electron diffraction methods and these results will possibly be published at a later date.

Acknowledgement

The authors are indebted to Dr. A. Kenneth Graham for helpful suggestions.

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Water in the Plating Room

By George B. Hogaboom

Engineer, Hanson-Van Winkle-Munning Co., Matawan, N. J.

This is, to our knowledge, the first authoritative article on troubles in the plating room traceable to impurities often present in water. The effects of calcium and magnesium salts (hardness) and chlorides formed from the chlorination treatment are considered. Roughness, pitting, porosity of nickel deposits may be due to "hardness", and soap troubles, tank corrosion and excessive anodic polarization may result from chlorination.—Ed.

Introduction

Generally speaking, it appears that which we often see and consider a necessary part of our existence is, at times, overlooked unless some unusual condition arises that requires investigation. In the plating room water is everywhere—in the cleaning solutions, acid dips, plating solutions, continuously running into the rinse tanks—an absolute essential without which no plating could be done.

Aside from the fact that it is essential, what do we know about water, that is, its effect in any of the solutions used, or, upon the characteristics of the electrodeposit? No recollection is had of any reference to the quality of water used, except in a few minor cases, where distilled water has been recommended for making a plating solution—generally a gold solution. Even then it is overlooked that the rinse water just previous to the plating solution is not distilled water and that in a very short time, the distilled water so carefully used to make the solution, is entirely replaced by the rinse water by the "drag in", and "drag out"[1]. The exact reason for using distilled water seldom, if ever, is given.

Hardness in Water

Water is classed as "hard" and "soft". "Hardness of water is of two kinds—temporary and permanent. In most waters, the calcium and magnesium are present as bicarbonates. The hardness is called 'carbonate hardness' or 'temporary hardness' which can be removed by lime or zeolite. Permanent hardness is more difficult of removal and requires soda ash or zeolite for its removal. The total hardness of a water is the sum of the temporary and permanent hardness. The average water user knows that the water is hard if large amounts of soap or washing compounds are required to 'break' the water or produce suds or lather. The use of soap serves to soften water, and is necessary, because water has but little cleansing power until the soap has neutralized the calcium and magnesium salts. The saving in soap averages three times as much as the cost of softening the water.[2]"

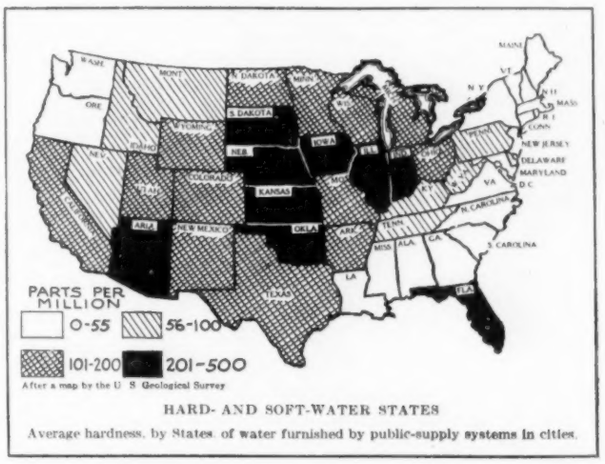
[1]Drag Out Losses from Plating Solutions, George B. Hogaboom, Metal Cleaning & Finishing, October, 1936.

[2]The Benefits of Soft Water, Literary Digest, July 13, 1929.

The localities where "hard" and "soft" waters exist are indicated in the map by the U. S. Geological Survey.

Effects of Hard Water in the Plating Room

In the plating room, where hard water is used as a matter of undetermined economy the rinse water tanks often become coated with a white sediment especially those directly after the alkali cleaner due to the precipitation of calcium and magnesium salts. Staining of electrodeposits may be traced to the use of a hard water for a rinse after the plating solution. The precipitated salts dry on the work and cause stains which are often considered due to the incomplete removal of the plating solution by the rinse water.



HARD- AND SOFT-WATER STATES

Average hardness, by States, of water furnished by public-supply systems in cities.

When hard waters are used as rinse waters just before the alkaline plating solution, there is the neutralization and the formation of precipitates, which are often insoluble. If the hardness of the water is of the "carbonate hardness" type, may not that account for the increase in the carbonate content of the plating solution as well as the generally accepted "decomposition of the cyanides"? If precipitates result, especially at the surface of the work, and the electric current is on, there is the probability of these precipitates being included in the electrodeposit causing pits, porosity and roughness. Many substances that at one time were considered harmless to the plating solution are now known to have a definite effect upon the character of the electrodeposit.

In bright nickel plating, the presence of some foreign substances in the solution may give a slight cloud to the deposit. When this is objectionable, an analysis is made of the solution to determine what chemical or addition agent

is deficient. May it not be that some of the salts from the rinse water used have accumulated to the extent that there is a neutralization or a precipitation at the cathode? In a plant in a state where the water is of the "average hardness", the rinse water before the nickel plating solution has a calcium content of about 18 parts per million. The total hardness, in a more understandable figure, is about 1.04 grains per gallon calculated as $CaCO_3$. The calcium salts in the water have been carried over by the work into the nickel solution and have accumulated until there are 7.9 grains of calcium calculated as calcium sulphate per gallon. In this bright nickel solution, long translucent needle-like crystals formed. Crystals of salt as a rule occur when the salt is in a saturated condition. In states where the hardness of the water is greater, this condition will be brought about more rapidly. What do we know about the effect of these salts in any plating solution whether they are present in small amounts or in concentrations at which they crystallize? The effect may be on the resistivity of the plating solution, the grain structure of the deposit or the character of the electroplate, whether it is porous or has the desired lustre. What effect the saturation of one or more salts in a plating solution has upon the travel of the metal ions has probably never been considered. We purify e.g. nickel solutions, and then contaminate them with rinse waters and wonder what is the matter!

Effect of Chlorine in Water

With the advance of civilization, the protection of health has been important and potable or "city" water has received considerable attention. It is now known to be essential to chlorinate potable water for protection against health hazards which are naturally above any difficulties that may arise in the electroplating industry. The degree of chlorination of water depends upon the conditions existing. In the Great Lakes districts, water is quite highly chlorinated. In one of the largest Eastern cities, the water is taken from a river that runs through a great many industrial towns. This water at its best, requires high chlorination and after a rain storm even higher. At times and fairly often, directly after a heavy rainstorm, the degree of chlorination required is such that if a piece of blue litmus paper is placed in the stream of water as it comes from the faucet an acid reaction will be had—the litmus paper will turn red—not "pink" such as before the introduction of pH control indicated to the plater that his nickel solution was in a good condition from an acidity standpoint.

Precipitation of Fatty Acid from Soap

The addition of chlorine to water whether hard or soft has added to the troubles of the plater. In a large manufacturing plant where intricately shaped articles are made, a small amount of neutral soap chips is added to the final hot rinse water to facilitate the "shedding" of water and make the drying of the plated articles more rapid. A storm came, the degree of chlorination of the water was automatically made at the source of supply and, of course, with no knowledge of what would happen to the plated work. There was a precipitation of the soap upon the work in the hot rinse water as a fatty acid. What a mess! The removal of that sticky almost insoluble mass without spoiling the finish is some problem—one of the unsolved problems.

If at that time the same strength of soap solution, or the same amount of soap chips was added to the steel ball burnishing barrel there would be another mess. The fatty acid will cling to the burnishing balls, to the work and to the sides of the burnishing barrel. The work instead of being bright would have no lustre; the steel balls having lost their bright finish will have to be rolled bright before they can be used again. The gummy mass on the wood lining of the barrel clings tenaciously and requires severe treatment before it will let go. Not realizing that the chlorination of the water used is the source of the trouble, the operator lays the blame on first one thing and then another and finally gives up, increases the soap content and just "works" out of his trouble. The use of a piece of litmus paper and the addition of some mild water softener, sodium carbonate or sodium orthophosphate before the addition of the soap chips will prevent a recurrence of such troubles without the condemnation of the soap or burnishing powder used. A writer recently stated that he saw no necessity of using compounds such as are used in one of the large brass districts in burnishing either steel or brass articles. A piece of litmus paper would have told the story. This seems not to be generally recognized and as storms are often of short duration few have taken the trouble to ascertain what the cause may have been.

In some of the larger plants, special tanks are being constructed to hold the burnishing solutions. When the solution is made, a water softener is first added and then the soap. The reduction of the cost of soap used and the consistently good work more than repays many times the cost of the added equipment and labor.

Changes in pH of Plating Solutions Due to Water Used

The colorimetric pH comparator set became generally used about the same time as rolled nickel anodes. One plater who prided himself on keeping a very efficient record of what occurred in his plating room registered a complaint that rolled nickel anodes caused his nickel solution to become rapidly alkaline. The pH had to be adjusted twice a day. The pH values were recorded and a curve drawn showing the changes. It never occurred to him that the amount of water and the condition of the water had anything to do with the pH changes. The "city" water used was considered to be almost equivalent to distilled water. It was not at that time chlorinated. As deep drawn shell work was being nickel plated, a large amount of water was carried into the plating solution with each batch of work. A record of the changes in the pH of the solution was kept for about six months. In the curves there were abnormal increases in the pH values on the alkaline side. It was suggested to the plater that he learn from the U. S. Weather Bureau whether there had not been a heavy rainstorm a day or so before the solution became so highly alkaline. The report was that on two days before each rapid increase in alkalinity a heavy rainstorm occurred. As the water was mostly "surface" water and as the soil in that locality was quite alkaline, the reason for the pH changes was readily understood—the rolled anodes were relieved of the indictment. In this case, the chlorination of the water was not the cause, but an interesting chapter was added to the story of water.

Polarization of Anodes

The chlorination of water may be the cause of other conditions. If a chloride is added to a zinc cyanide plating solution, the zinc anodes will polarize to such an extent that the current density desired can be had only by increasing the pressure (voltage). The increase of pressure will create a condition at the anode that will cause a rapid building up of a partly and slowly soluble film on the anode that may stop the flow of current.

How often is the water used considered? The remedy applied is generally the addition of a "conducting" salt to the plating solution and then, so many times, the condemnation of the anodes.

Corrosion of Tanks

Steel tanks develop leaks or corrode more rapidly than expected. May not that be due to the water used? When the electric current is on, the steel tank may be in direct circuit or it may be as an intermediary electrode. In either case current is passing through it. This cannot be entirely avoided as the plating tanks hold metal ions which come into direct contact with the steel. Iron is readily attacked by chlorides, especially electrochemically. If highly chlorinated water is used in the electric cleaner or in the plating solution, and any part of the tank becomes anodic, there is certain to be an attack, or rather a solution of the iron which may be most rapid at welds, and leaks are bound to occur.

Many "surface" waters contain considerable organic acids some of which may not be neutralized by the addition of sodium carbonate or similar alkali salts. This is especially true of water drawn from a pond or a private reservoir. In some ponds, the water has a pH value of 3.0. A small manufacturing plant was accused of running waste pickle solutions into a pond. The amount of water that ran over a dam at one end of the pond was calculated and to increase the pH to 3.0 required the addition of sulphuric acid which would cost $110.00 per day. This plant used one carboy of acid a month! It is being found that some organic salts in many plating solutions cause trouble. It is to remove such compounds that activated carbon is recommended and used in filtering solutions.

In the Middle West, iron is present in the water used for both the household and the factory. It is now recognized that iron salts in a nickel solution cause pitted deposits; in acid copper solutions, rough deposits; in acid zinc solutions, a deposit that will affect the results of the Preece test and probably the protective value.

How often is the water in the final hot rinse tank changed? The general practice is to add water to replace evaporation. In localities where "solids" e.g. iron, calcium, magnesium are in the water used, there is an accumulation of those salts in the hot rinse. These salts are not carried off by the steam. When these salts increase in concentration, the amount present in the "drops" that dry on the work is often sufficient to cause discoloration of the deposit which is annoying and difficult to remove. It is a good plan to discard the hot water rinses at least once each day.

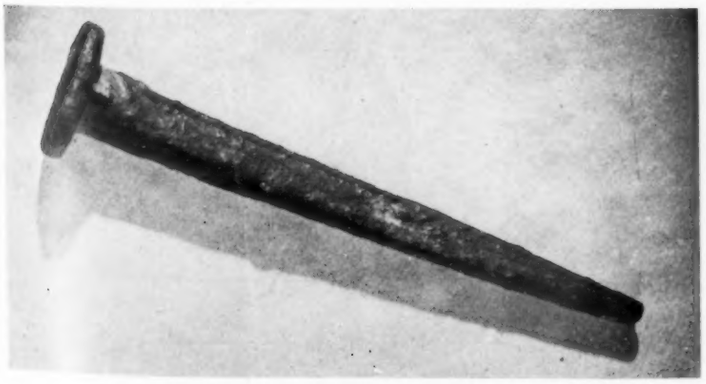
The water used in a plating room may be found to be the source of many failures and yet we know practically nothing about what any composition of water may or may not bring about.

Conclusion

If the purity of chemicals is insisted upon and chemicals are purchased on definite specifications, of what value are the conclusions drawn when the purity of water used to make the plating solution, or is carried into the solution by the "drag in", is not known? A chemical may be demanded that is free from a chloride yet be dissolved in a chlorinated water or one with a definite sulphate content and this added to a "hard" water high in calcium sulphate.

How much water is there in a plating solution? A nickel solution of the Watt composition has 14.6% solids and 85.4% water. A Rochelle salt cyanide copper solution contains 11.2% solids and 88.8% water. The purity of the chemicals used may become negligible by comparison! The big unsolved problem of the plating room is WATER.

Heavy Zinc Coating Lasts 55 Years



The value of heavy galvanizing was well brought out by the shingle nail shown in the accompanying illustration which was picked up near Triechlers, Pennsylvania. It had given 39 years service on the roof of a quarry building and had lain on the ground for 16 years since the building was torn down. Because it had not rusted it was thought at first to be zinc, but examination showed it to be an old style, wrought iron nail heavily galvanized. In spite of the fact that the galvanizing was quite irregular and had nearly disappeared in minute areas, a heavy coating still remained—ample to protect the iron from rusting even after the many years of exposure.

(Courtesy of The New Jersey Zinc Co., New York City).

Some Reflectivity Relationships of Individual Metals to Electroplated Alloys

By Lionel Cinamon, Ch. E.

President, The Special Chemicals Corp., New York, N. Y.

This is the concluding part of Mr. Cinamon's article, the first part of which appeared in the March issue of Metal Industry.—Ed.

Reflectivity of Copper, Brass, Gold and Alloys

NOTE the similarity of pattern in the curves of copper, brass, gold and alloy B* (Fig. V) and the slight dissimilarities that give them their individual colors. Take copper first. At 4810A and at 5260A, it displays two great depressions in the middle blue and green. The peak between at 5000A is at a secondary color, blue-green and is counterbalanced by the complementary secondary green-yellow and orange. The great predominance of red over a wide band from 5940A to beyond 7000A, plus a very small amount of violet, gives copper its pink color.

Brass derives its color by having a slight peak in middle green at 5260A and a slight depression in the secondary orange 5940-6220A. The curve in the green predominates, since here we have a primary color with blue-green and yellow-orange secondary counterbalancing. Yellow at 5740A predominates with adequate support from 6220-7000A in the red. The secondary violet plays little part, because the eye sees violet very poorly.

Again note the similarity between the curves of gold and alloy B. The general contours are close. However, at 5200A, gold exhibits a slight peak. Between 5200 and 5740A, gold exhibits less reflectivity than alloy B with the gap gradually closing up. Again beyond 5940A, a divergence occurs, gold falling below alloy B. With the exception of the 5200A peak in the green and the 3% difference in the middle red, these differences are minor.

Now we come to the possibility of using our knowledge of metal reflectivity in the formation of alloys having a desired color. Let us examine alloy B, a gold-colored alloy of copper, zinc and tin (See footnote page 170).

If we assume that the reflectivity of an alloy is made up of the sum of the reflectivities of the individual metals composing that alloy and in proportion to their percentage composition, then a curve drawn on such a basis should very closely match a curve made from actual measurements.

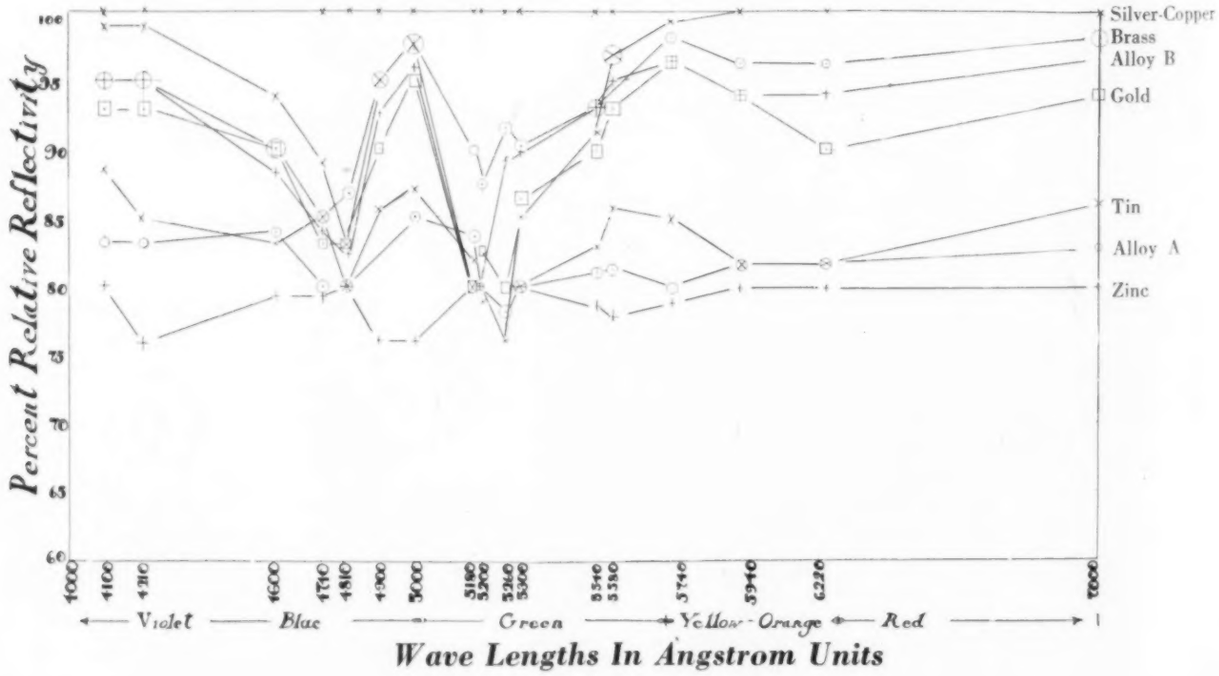


FIGURE V

Filter	Silver	Chromium	Rhodium	Alloy A	Tin	Gold	Cadmium	Nickel	Copper	Alloy B	Brass	Zinc	Aluminum
350	100	76	87	83	88	93	78	80	93	95	95	80	87
150+47C5	100	76	87	83	85	93	76	80	99	95	95	726	85
19C4	100	76	88	84	83	90	78	80	94	88	90	79.2	848
19C5+511	100	78	86	80	85	83	74	79	89	84	85	79	84
19C5+382	100	78	87	80	80	83	73	76	83	82	87	80	84
45M+382	100	75	885	85	855	90	75	80	95	925	95	76	82
45M+5882	100	76	89	84	87	95	76	81	98	96	97	76	83
5882+382	100	75	86	80	82	80	726	72	80	80	90	805	825
5882	100	74	83	78	79	83	76	77	80	89	89	80	83
6/N+15G	100	74	86	80	80	80	66	68	76	89	92	80	81
15G+5882	100	73.6	8566	81	80	86	75	76.8	85	90	904	80	832
5882+22E	100	76	86	81	83	90	73	77	91	93	93	79	82
22E+1312	100	73	84	80	85.5	93	76	78	97	95	97	78	85
1312+23A	100	744	87	82	85	96	77	78	92.2	96.4	98	79	83
25A	100	72	82	84	82	94	78	78	100	94	96	80	816
29F	100	72	84	82	82	90	76	76	100	94	96	80	832
700	100	76	86	83	86	94	78	80	100	96	98	80	84
None	100	77	856	816	85	89	79	79	93	93	94	804	87

FIGURE VI

Data on reflectivity of metals and alloys.

	Copper	Zinc	Tin	Alloy A 56.8% Cu, 32.6% Zn, 10.6% Sn			Theoretical Total Reflectivity	Actual Reflectivity Alloy A	Alloy B 69.3% Cu, 29.4% Zn, 1.3% Sn			Theoretical Total Reflectivity	Actual Reflectivity Alloy B
				Cu	Zn	Sn			Cu	Zn	Sn		
White Light	93	80.4	85	52.7	12.99	22.83	80.46	81.6	64.9	24.65	0.78	89.33	93
4100	99	80	88	56.1	12.9	23.65	92.65	88.0	69.0	25.56	0.81	93.14	96
4210	99	75.6	85	56.1	12.5	22.85	91.45	830	69.0	22.3	0.78	92.08	93
4600	94	79.2	83	53.3	13.05	22.39	88.68	840	65.5	23.32	0.77	89.59	94
4740	89	79	85	50.9	13.05	22.82	86.27	800	62.0	24.3	0.77	87.87	84
4810	83	80	86	47	13.2	24.5	84.7	860	57.8	24.6	0.84	82.19	82
4900	95	76	85.5	53.8	13.35	23.0	89.35	850	66.3	22.4	0.79	89.99	92.5
5000	92	76	87	56	12.55	23.4	91.95	840	68.4	22.9	0.80	91.6	96
5180	80	80.5	82	53.3	13.27	22.04	80.61	808	55.8	23.7	0.76	80.26	80
5200	80	80	79	45.3	13.05	21.14	79.59	780	55.8	23.6	0.79	80.03	84
5260	76	80	80	43.1	13.2	21.5	77.8	800	53.0	23.6	0.74	77.34	84
5300	85	80	80	48.1	14.2	22.3	82.8	840	59.3	23.6	0.74	83.64	80
5340	91	79	83	52.5	13.1	23.0	87.5	840	63.5	24.3	0.77	87.51	98
5360	97	79	85.5	55	14.1	24.82	92.1	800	67.6	23.9	0.79	91.69	95
5740	93.2	79	85	56.2	14.03	22.02	93.05	840	69.2	23.9	0.77	93.27	96.4
5740 7000	100	80	82	56.6	13.2	22.02	91.82	840	69.63	23.6	0.75	93.98	94
6220 7000	100	80	82	56.6	13.2	23.02	91.82	820	69.63	23.6	0.75	93.98	94
7000	100	80	86	56.6	13.2	23.1	92.9	830	69.63	23.6	0.75	94.01	96

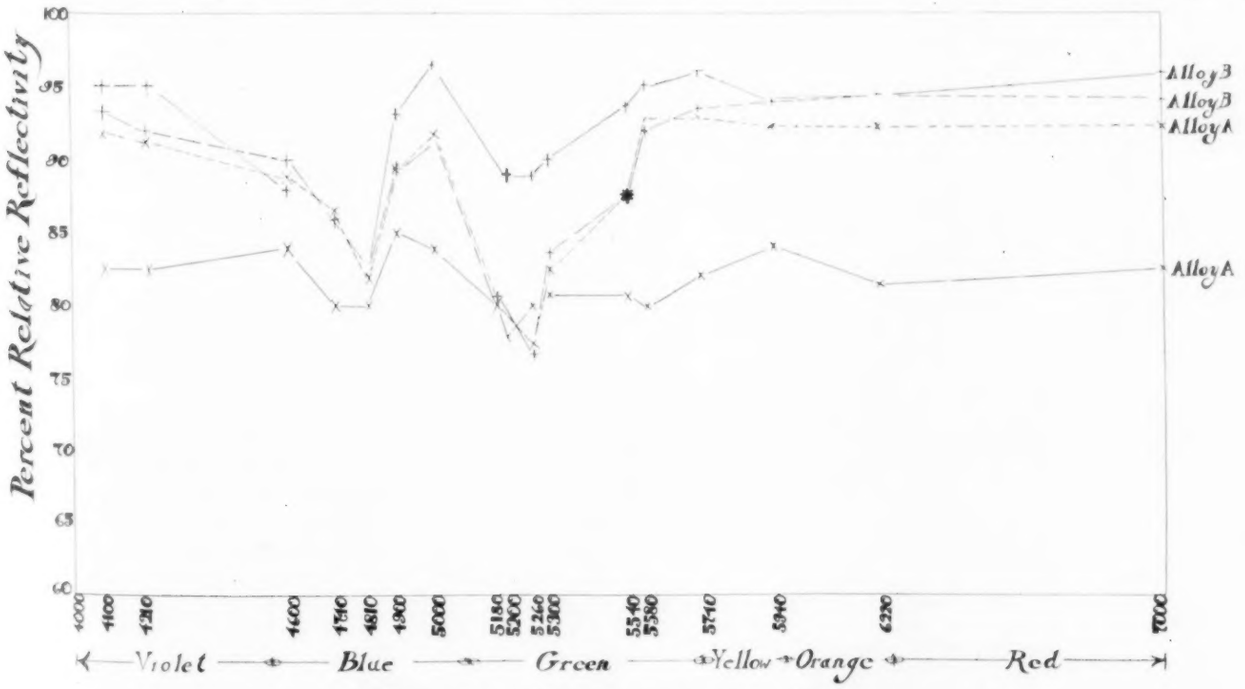
FIGURE VII

Theoretical and actual reflectivity of alloys.

In Fig. VII we have listed the reflectivities of copper, zinc and tin and calculated what part their individual reflectivities should play in the reflectivity of the alloy. We have alongside listed the actual measured reflectivity of alloy B. In Fig. VIII the values are plotted for comparison.

The solid lines are the result of direct measurement, while the dotted lines are according to the theory just outlined. The theoretical value closely approximates the actual value for alloy B with the one exception between 5000 and 5540A, the general trend of the actual curve, however, being maintained.

In the case of alloy A†, the same procedure was followed.



Wave Lengths In Angstrom Units

FIGURE VIII

The curves are not as close together; however, the general trend of the actual curve is again followed.

We can see two possible reasons for the discrepancies. First is the good possibility of compound formation between the metals, and the second, errors that are due to the crudity of our apparatus.

Compound formation between metals is known in formation of alloys thermally. The Critical Tables are filled with hundreds of examples. For instance, copper and tin combine to give definite compounds such as Cu_3Sn, and Cu_4Sn, while copper and zinc combine to give Cu_2Zn_3. In each instance, the compound is harder than its constituents, has different color and other properties. If such compounds are formed in electroplates, undoubtedly they modify the characteristics of the plate. Alloy A and alloy B are both harder than their constituents, copper, zinc and tin. In plotting a theoretical reflectivity curve, allowance must be made for the possibility of compound formation.

Our experimental data seem to indicate that electroplated alloys are similar to thermal alloys in having both solid solution and compound formation. Once knowing the quality and quantity of the compounds formed as well as the quality and quantity of the solid solutions formed, we should be able to predict the color of an alloy electroplate, without ever having formed that alloy.

For the investigation at hand, our comparatively simple apparatus serves our purpose. Our work to date indicates several improvements that can be made in the apparatus and manipulation; first, in respect to the spectral "cut-off" and second in regard to reducing the other variables in the apparatus.

No filters of gelatin or glass type can give sharp "cut-off" over the spectrum, so we have to turn to other means.

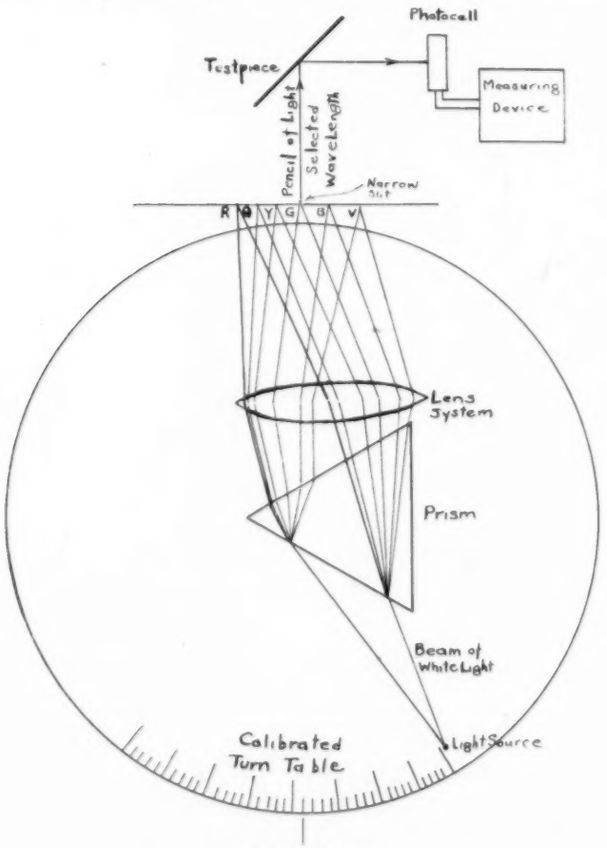


FIGURE IX

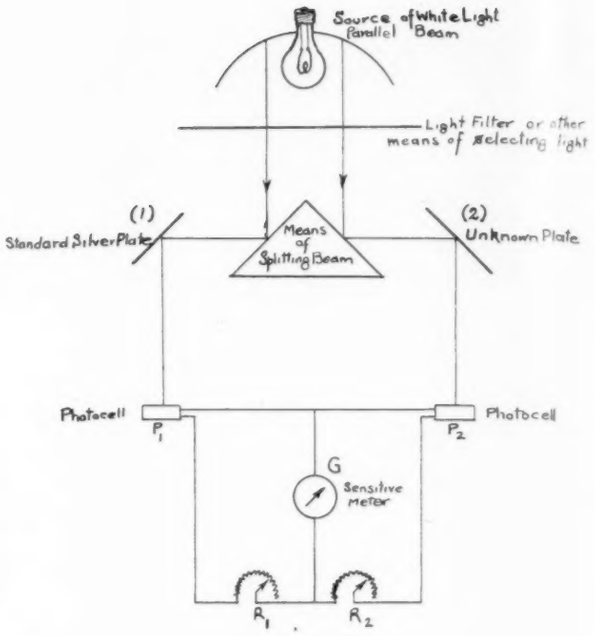


FIGURE X

Sources of monochromatic light like the mercury arc could be used, but would involve much complication. A simpler method can be used.

If white light is passed through a prism, it is dispersed and a spectrum produced. If a blank containing a narrow slit is placed in the path of the dispersed light, only light of selected wave lengths comes through to be reflected from the test piece.

The source of light and the prism should be fixed on a calibrated turntable while the slit and test piece should be independently mounted. (See Figure IX).

For the prism a diffraction grating on a plane surface or on a concave mirror could be substituted using the proper optical system.

In several respects the apparatus can be improved aside from the waveband angle.

Heat absorption by the gelatin filters shrinks and distorts them. Very slight fluctuations in the line voltage cause great variance in the meter readings. The apparatus requires continual adjustment to compensate for this variable. This difficulty may be overcome in the following manner:

If light were split equally in two parts, one portion impinged upon the standard, and the second portion upon the unknown, and the reflected light from each plate be absorbed by separate photocells, it would be possible by means of a Wheatstone Bridge arrangement to determine by direct reading the relative reflectivity of the unknown to the standard.

In Fig. X, by placing two silver standards in positions (1) and (2) and adjusting the resistances R_1 and R_2 until the meter G reads zero, when the unknown is placed in position (2) the circuit is unbalanced. If the meter dial is properly calibrated, the percent reflectivity can be read directly. In such a circuit, line fluctuation of the light source will cause no difficulty since both sides of the circuit will be affected alike and so balance out.

*Alloy B is known as "Spekyello No. 10" and formerly as "Goldglo No. 10."

†Alloy A is called "Spekwite" commercially.

Determination of Free Sodium Cyanide and Ammonia in Brass Plating Solutions

By Samuel Heiman and Wallace M. McNabb*

Department of Chemistry and Chemical Engineering
University of Pennsylvania, Philadelphia, Pa.

An evolution method has been developed for determining the total sodium cyanide and ammonia content of brass plating solutions with an error of about 1 per cent. The free sodium cyanide content may be calculated, knowing the copper and zinc content, with an error of approximately 10 per cent.—Ed.

THE free or uncombined cyanide content of a brass plating solution refers to the sodium cyanide in excess of that required to form the complex copper and zinc cyanides[2]. The amount of free cyanide in the plating bath has a marked effect on the appearance and composition of the brass deposit, the cathode and anode efficiencies, the anode polarization, and the conductivity of the solution[15, 16, 19].

In general, the free cyanide in any cyanide plating solution is determined by titration with silver nitrate, using potassium iodide as indicator[2, 20]. Inconsistent results are obtained, however, when this method is applied to brass plating solutions. The removal of the sodium carbonate before titration with silver nitrate is said to overcome most of the difficulty[3, 8], although the interference of sodium carbonate may be avoided by suitably diluting the sample to be titrated[16]. Pan[16] has shown that ammonium hydroxide and potassium iodide influence the value of the free cyanide, and recommends that the titration be carried out in the presence of 0.37 *N* potassium iodide indicator in order to give accurate results. However, he neglected to consider the effect of free alkali or pH, which Blum and Hogaboom[3] have pointed out makes the determination and calculation of free cyanide uncertain.

In contrast with this lack of agreement regarding the direct titration of free cyanide in brass plating solutions, the determination of cyanide in copper and zinc plating baths has been satisfactorily worked out. Thompson[21] has shown that when a copper cyanide solution is titrated with silver nitrate, a reproducible value of free cyanide—that is, the cyanide in excess of that required to form the compound $Na_2Cu(CN)_3$—is obtained when 0.5 to 1.0 gram of potassium iodide per 100 ml. of solution is used as an indicator. If the same method of titration for free cyanide is applied to a zinc cyanide solution, inconsistent results are obtained, owing to the effect of variations in total alkalinity or pH on the equilibrium between sodium zincate and sodium zinc cyanide. However, an accurate and reproducible value of the total cyanide may be obtained by adding an excess of sodium hydroxide to the solution and then titrating with silver nitrate[4]. When this procedure for the determination of the total cyanide in a zinc plating solution is applied to a brass plating solution, the cyanide in the zinc complex plus the free cyanide should be obtained. One object of this investigation was to evaluate this method.

*Reprinted from *Industrial and Engineering Chemistry*, Analytical Edition, Vol. 10, No. 12, (Dec.), (1938), pp. 698-701.

Evolution Method for Total Cyanide and Ammonia

Coates[7] has recommended an evolution method for determining the total cyanide in a brass plating solution, by means of which the uncombined cyanide can readily be calculated. Wick[22] has determined the total cyanide in a cyanide silver plating solution by distilling with sulfuric acid. It was thought desirable to investigate this evolution method for the determination of total cyanide, with the idea of making it as simple as possible in operation and detail, so that it could be used as a routine test.

Pagel and Carlson[14] have recently decomposed sodium cyanide quantitatively by the distillation of hydrocyanic acid from sulfuric acid solutions, and Morris and Lilly[13] have made further studies of this method.

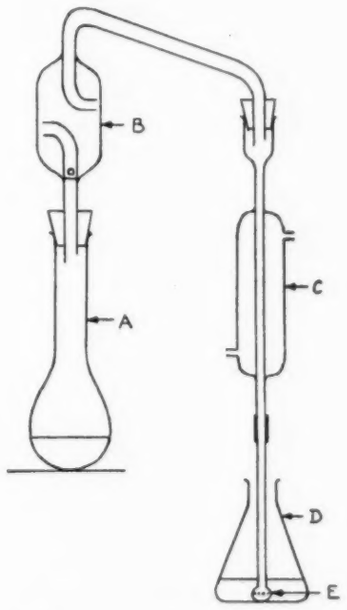


Figure 1. Distillation Apparatus

A. 300-ml. short-necked Kjeldahl flask
B. Connecting bulb, Southern Oil Co. model
C. Condenser, 50 cm. long
D. 250-ml. Erlenmeyer flask
E. Gas distributor. Miller [12] has shown that this device ensures better absorption by breaking up the large bubbles of gas.

Using the apparatus shown in Figure 1, tests were made with technical zinc cyanide. Dilute sulfuric acid was added to zinc cyanide suspended in water and the hydrocyanic acid distilled into a sodium hydroxide solution. The sodium cyanide formed was titrated with standard silver nitrate. The average of four distillations gave 99.88 per cent recovery of the cyanide content, as compared with the results obtained by titration of the total cyanide with silver nitrate in the presence of potassium iodide and sodium hydroxide.

In a similar manner, it was found that by distilling cuprous cyanide with a mixture of sulfuric and hydrochloric acids[1], or with hydrochloric acid alone, an average recovery of 99.73 per cent of the theoretical cyanide content of the cuprous cyanide was obtained.

An old brass plating bath may contain iron as ferrocyanide, and the cyanide in this ferrocyanide will be included in the total cyanide as determined by the evolution method. Knowing the iron content of the plating solution, the sodium cyanide equivalent to the ferrocyanide may be calculated, and accounted for in the calculation of the free cyanide. However, in a given plating bath, the amount of ferrocyanide will not change appreciably, and for routine control work the correction will remain substantially constant and may be neglected.

There is some disagreement in the literature as to the formula of the complex zinc cyanide present in a brass plating solution. Most text books[5] give $Na_2Zn(CN)_4$. Pan[18] concluded that the compound has the formula $NaZn(CN)_3$, but there was considerable criticism of his work. The authors have chosen the $Na_2Zn(CN)_4$ formula in calculating the free cyanide from the results obtained by the evolution and titration methods.

Ammonium hydroxide is commonly added in very small quantities to a fresh brass plating bath at the time of preparation in order to improve its initial operation[6]. One pint of concentrated ammonium hydroxide per 100 gallons of solution is usually recommended. It is believed that a small quantity of ammonia forms in an old plating bath as a result of decomposition of free cyanide[23].

More recently Pan[17] has shown that the presence of ammonia in somewhat larger quantities—i. e., 1 to 7 ml. per liter of solution—markedly affects the deposits that may be obtained from a brass plating bath. While the amounts of ammonia recommended by Pan are not known to be employed commercially, it would be interesting to know the ammonia concentration of an old plating bath. Furthermore, if a convenient method for the control of the ammonia concentration were available, some of the advantages recommended by Pan might be realized in practice. An evolution method to determine ammonia in cyanide solutions was therefore investigated.

Meeker and Wagner[11] have suggested the use of a boric acid solution instead of a standard acid solution for the absorption of ammonia. Using this modification of the standard evolution method, four distillations using C. P. ammonium chloride gave an average recovery of 99.74 per cent of the calculated amount of ammonia. This method offers the advantage of requiring only one standard solution.

Procedure for Total Cyanide

The apparatus was assembled as shown in Figure 1. Five milliliters of brass solution containing ammonia equivalent to 0.22 gram of ammonium chloride were transferred to the Kjeldahl flask, and then 50 ml. of water and a few pieces of porous plate were added. Seventy milliliters of 1.5 per cent sodium hydroxide were added to the Erlenmeyer flask receiver, 10 ml. of concentrated hydrochloric acid, diluted to 100 ml., were poured into the distillation flask, and the connecting bulb was immediately replaced. The solution was then distilled for 45 minutes, during which time about half the contents of the flask distilled over. After the distillation, the condenser and gas distributor were rinsed with distilled water, running the washings into the receiver. The sodium cyanide in the receiver was titrated with 0.100 *N* silver nitrate solution in the presence of 6 ml. of 6 *N* ammonium hydroxide containing 3.3 per cent of potassium iodide. The end point was obtained at the appearance of a bluish opalescence[9]. The solution remaining in the distillation flask was used for the determination of ammonia. Cyanide and ammonia were thus determined on the same sample.

Procedure for Ammonia

After cooling the flask to room temperature, 70 ml. of 10 per cent sodium hydroxide solution were added to the Kjeldahl flask and the ammonia was distilled into an Erlenmeyer flask containing 80 ml. of 4 per cent boric acid. The receiver was kept on an ice bath, and the distillation carried out for 45 minutes during which time about half of the volume of the solution distilled over. After rinsing the condenser and gas distributor, the ammonia in the receiver was titrated with standard 0.1 *N* hydrochloric acid using 2 drops of methyl red as indicator.

Discussion of Results

A typical brass plating solution, similar to that used in practice, was made up with the following composition:

Brass Plating Solution No. 1

	G./l.	
Cu	18.63	
CuCN	26.25	C. P.
Zn	4.59	
$Zn(CN)_2$	8.25	Tech. 92.5% of the theoretical cyanide content by analysis
NaCN	43.50	C. P. 96.6% NaCN by analysis
Na_2CO_3	30.00	C. P.

By calculation on the basis of direct analyses of the above reagents, 5 ml. of this solution contain 0.3140 gram of sodium cyanide (including the sodium cyanide equivalent to the cyanide in the cuprous cyanide and zinc cyanide).

Table I gives the results obtained on distilling 5 ml. of brass solution No. 1 as given in the procedure. An average of 99.1 per cent of the total cyanide in the plating solution was recovered. It is interesting to note that after the solution had stood for two months in the laboratory, about 1.5 per cent of the total cyanide had decomposed and was recovered as ammonia on distilling with sodium hydroxide.

The uncombined sodium cyanide in the brass plating solution was calculated in the following manner: The copper and zinc contents of the solution multiplied by 2.312 and 2.998, respectively, gave the sodium cyanide equivalents in the cyanide complexes $Na_2Cu(CN)_3$ and $Na_2Zn(CN)_4$. The sum of these equivalents subtracted from the total cyanide content gave the free or uncombined sodium cyanide.

As a check of the previous work, a second brass plating solution was prepared having the following composition:

Brass Plating Solution No. 2		
	G./l.	
Cu	18.63	
CuCN	26.25	C. P.
Zn	4.59	
ZnO	5.72	C. P.
NaCN	50.37	96.4% NaCN by analysis
Na_2CO_3	30.00	C. P.

Five milliliters of this solution contain 0.3147 gram of total sodium cyanide by calculation, including the sodium cyanide equivalent to the cyanide in the cuprous cyanide.

Table I also gives the results obtained in analyzing this second solution for both total cyanide and ammonia by the evolution methods previously described. The average recovery of total sodium cyanide, 99.09 per cent, is about the same as that with the first brass plating solution. The slightly low values obtained on the total cyanide recovery are probably due to hydrolysis of the sodium cyanide to ammonium formate during the distillation[10]. This may account for the fact that the recovery of the total cyanide is about 1 per cent low and the ammonia recovery is about 1 per cent high.

Even an excessively large amount of sodium carbonate (90 grams per liter) did not interfere with the sharpness of the end point or the accuracy of the method. The dilution of the sample being titrated was found to have only a slight effect on the value of the sodium cyanide. The effects of ammonia, sodium carbonate, and dilution on this method of titration are given in Table II.

TABLE II. TITRATIONS OF BRASS PLATING SOLUTION No. 2

Sample for titration, 5 ml. Volume at end of titration, 100 ml. Sodium hydroxide used, 4.0 grams. Potassium iodide used, 2.0 grams)

Effect of Na_2CO_3		Effect of Dilution			
Na_2CO	NaCN [a] found	Volume at end of titration	NaCN found	Effect of NH_4OH [b] Aqua ammonia	NaCN found
G./l.	*G./l.*	*Ml.*	*G./l.*	*Cc./5 ml. solution*	*G./l.*
30	20.10	75	20.00	0.2	20.10
60	20.10	100	20.10	1.0	20.50
90	20.10	150	20.20		

[a] Calculated amount of free cyanide plus NaCN equivalent to $Na_2Zn(CN)_4$ equals 19.87 grams per liter.

[b] 10 ml. aqua ammonia per liter of brass plating solution equals 0.05 ml. per 5-ml. sample.

TABLE I. DETERMINATION OF TOTAL CYANIDE AND AMMONIA IN BRASS PLATING SOLUTIONS BY THE EVOLUTION METHOD

(5 ml. of brass plating solution used in all distillations. Weight of "NaCN present" is the sum of sodium cyanide plus sodium cyanide equivalents of copper cyanide and zinc cyanide.)

Brass Solution No.	Condition	Total NaCN Present	NaCN Recovered		Free NaCN Present	Free NaCN Found		NH_3 Added (as NH_4Cl)	NH_3 Recovered	
		G./5 ml. solution	*Gram*	*%*	*G./l.*	*G./l.*	*%*	*G./5 ml. solution*	*Gram*	*%*
1	Fresh	0.3140	0.3110	99.06	--	--	---	None	----	---
		0.3140	0.3112	99.13	--	--	---	None	----	---
			Av. 0.3111	99.09	6.98	6.40	91.68	None	----	---
1	After standing two months	0.3140 (Originally)	0.3063	97.54	--	--	---	0.07180	0.07305	101.7
		0.3140 (Originally)	0.3067	97.68	--	--	---	0.07099	0.07266	102.3
			Av. 0.3065	97.61	--	--	---	0.07140	0.07286	102.0
2	Fresh	0.3147	0.3115	98.97	--	--	---	0.07193	0.07247	100.9
		0.3147	0.3119	99.10	--	--	---	0.07076	0.07147	101.0
			Av. 0.3117	99.04	6.08	5.48	90.14	0.07135	0.07197	101.0

Titration Method for Free Cyanide

Five milliliters of brass plating solution No. 2 were titrated with 0.1 *N* silver nitrate solution in the presence of various amounts of potassium iodide and sodium hydroxide as recorded in Figure 2. The horizontal dotted line shows the value of 19.87 grams per liter of sodium cyanide, which is that calculated on the basis of the free cyanide plus the sodium cyanide equivalent to the sodium zinc cyanide, $Na_2Zn(CN)_4$. [The zinc content of the solution multiplied by 2.998 gives the sodium cyanide equivalent to the $Na_2Zn(CN)_4$.] Using 100 ml. as the total volume at the end of the titration with silver nitrate, in the presence of from 2.0 to 4.0 grams of sodium hydroxide and 1.5 to 3.0 grams of potassium iodide, the above calculated value of sodium cyanide is obtained.

These results indicate that the cyanide content of the sodium copper cyanide, $Na_2Cu(CN)_3$, is not titrated under these conditions. It is possible therefore, to determine the free cyanide by direct titration with silver nitrate in the presence of potassium iodide and sodium hydroxide, provided the zinc content of the plating bath is known.

The presence of ammonia in cyanide plating solutions gives higher values of free sodium cyanide when determined by titration with silver nitrate[16, 21]. A similar effect of ammonia has been observed in titrating the cyanide present as free sodium cyanide and sodium zinc cyanide in a brass plating solution using silver nitrate, sodium hydroxide, and potassium iodide as recommended above. Since only 5 ml. of the plating solution are used in the titration, the amount of ammonia normally present in a brass plating bath is not sufficient to affect the accuracy of the titration.

Titration Procedure for Determining Free Cyanide

Five milliliters of the brass plating solution were transferred to a 250-ml. Erlenmeyer flask and 20 ml. of 20 per cent sodium hydroxide solution, 20 ml. of 10 per cent potassium iodide solution, and 40 ml. of water were added. The solution was then titrated with 0.1 *N* silver nitrate solution to the appearance of a bluish opalescence.

The free sodium cyanide in the brass plating solution may be calculated as follows: The number of milliliters of silver nitrate used in the titration multiplied by 1.960

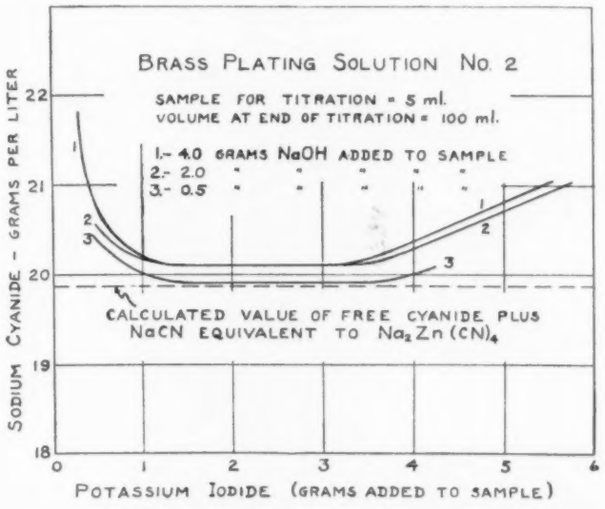


Figure 2. Determination of Cyanide in Brass Plating Solution

equals the number of grams per liter of sodium cyanide on the basis of the free cyanide plus the sodium cyanide equivalent to the sodium zinc cyanide, $Na_2Zn(CN)_4$. The latter may be found by multiplying the zinc content of the bath (expressed in grams per liter) by 2.998. The free sodium cyanide may be obtained by difference.

Summary

The total cyanide and ammonia content of a brass plating bath may be determined by evolution methods. The error is about 1 per cent. The free cyanide may be calculated, knowing the copper and zinc content, with an error of approximately 10 per cent. The free cyanide may also be determined by a titration method in which both the free cyanide and sodium cyanide equivalents of the sodium zinc cyanide, $Na_2Zn(CN)_4$, are titrated. In this case the free cyanide may be calculated knowing the zinc content. The error by the titration method is about 2 per cent.

In the evolution method, the accuracy of the determination of free cyanide depends upon the accuracy of the zinc and copper determination. The accuracy obtained by the titration method depends upon the accuracy of the zinc determination. However, since the cyanide in the brass plating solution must be destroyed before the ammonia may be determined, the analyses for free cyanide and ammonia by the evolution method may be conveniently carried out together.

The free cyanide may be determined by either the evolution or the titration method with sufficient ease and accuracy for practical routine control purposes.

Acknowledgment

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Technical and Sales Representatives of the Electroplating Division E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

(Top row) C. M. Hoff, R. O. Hull, H. H. Blouch, E. W. Schweikher, J. C. Pickard, R. R. Blair, H. L. Benner, H. I. Hansen, H. W. Kennedy, E. C. Friedl. (Bottom row) R. H. McCahan, W. A. Geiger, M. L. Ross, W. J. Schneider, F. F. Oplinger, C. J. Wernlund.

The Testing and Stripping of Zinc and Cadmium Electrodeposits

By Dr. B. Egeberg and Nathan E. Promisel

International Silver Co.,
Meriden, Conn.

Methods are described for measuring local and average thicknesses of zinc and cadmium deposits on various types of basis metals.—Ed.

A. Introduction

Zinc and cadmium owe their prominent, important position in the field of electroplating primarily to their ability to protect ferrous metals from corroding. In this respect, they are the outstanding examples of that group of metals popularly termed "sacrificial", because they are themselves sacrificed to the corrosive medium while preventing attack of the more noble basis metal.

To this highly desirable property of the metals may be added certain other features. The electrodeposition of either offers no particular difficulties, even in relatively great thicknesses, and may be carried on at very attractive current densities (speeds). Cadmium has a very pleasing color and physical appearance and may be plated in a bright condition. In recent years, the development of important metallurgical outlets for the material has resulted in a scarcity of the metal for electroplating purposes and an increased initial cost, so that its close relation, zinc, has grown in popularity and has tended to displace it in the electroplating industry. Zinc has the advantages of being cheaper and readily available, and even of affording more effective protection against corrosion in certain cases, but on the other hand, it is distinctly inferior to cadmium in color and physical appearance, in its appearance as plated, and in its ability to retain any particular finish given to it when used as a top plate. Nevertheless, due to its offsetting advantages mentioned above, it has become a very widely used protective metal. It is used extensively also for the production of hot-dipped coatings, which will likewise be considered in this article.

The testing of the thickness of protective coatings of zinc and cadmium is all the more important because sufficient metal must be available for "sacrifice" to last for the anticipated life of the article or material under consideration. Otherwise, corrosion of the basis metal is in order. On the other hand, the testing of porosity is relatively unimportant, since even if the corroding medium penetrates a porous coating and reaches the basis metal, the latter is still protected by the "sacrificial" action of the zinc or cadmium. It is true that the disappearance of protective metal by dissolution is thereby accelerated, and for this reason porosity should by no means be ignored, but the distinction between this case and that of nickel, for example, which is useful only in the sense of preventing the corroding medium from reaching the basis metal, should be clearly realized. The importance of thickness naturally implies the importance of testing for distribution of plate and for wear and abrasion resistance. In the case of zinc covered wire, where recently electroplating has made deep inroads on the popularity of hot-zincing, adhesion and ductility tests loom in equal importance.

B. Preliminary Investigation

For the greatest part, zinc and cadmium are deposited upon ferrous basis metals, though occasionally they are used over nickel-silver, as when it is desired to avoid green corrosion products on nickel-silver salt-tops. In some cases, they remain the top plate. In other cases, where different final appearances are desired, other metals are plated over them.

In plating over zinc, the metals copper, nickel, and chromium are most often used, and of these, nickel is favored. Copper is absorbed by the zinc and unless present in appreciable thickness (.0003") results eventually in peeling and failure of the plate. Similar considerations hold true if the copper is thick enough but if the zinc is too thin. The plating of chromium over zinc, while practical, is not always easy and furthermore results in a milky deposit. Nickel on the other hand is not absorbed by zinc and may be plated so as to give a deposit which is readily brought up to a satisfactory finish. On the other hand, it is more difficult to "throw" the nickel satisfactorily into recesses than when using copper, so that both methods of plating on zinc are in vogue.

In the case of cadmium, the difficulty with absorption of copper does not exist (unless extremely thin, "flash" coatings of either are considered), nor is it as difficult to plate with nickel. Otherwise, the same considerations as above hold. In addition, cadmium is used under silver.

The detection of chromium, nickel, and copper when plated over zinc and cadmium has been dealt with in previous articles. The presence of zinc or cadmium, and the differentiation between them, are indicated by several simple tests. Both cadmium and zinc are very soft, roughly placing them in a hardness class with lead, tin, and silver.

The characteristic bluish-white color of zinc readily distinguishes it from any of the other named metals and its ready solubility in diluted nitric, sulfuric, and hydrochloric acids and sodium hydroxide serves as a confirmatory test. Cadmium is not soluble in sodium hydroxide, thus differing from zinc, lead, and tin, and it may readily be distinguished from silver by the greatly superior whiteness of the latter. These three properties then, of softness, color, and acid and alkali solubility are generally sufficient to establish the identity of an unknown plate with respect to zinc and cadmium. Confirmatory tests for silver have been described in an article dealing with that metal.

The use to which the plated article being examined is to be subjected usually furnishes a clue as to the general thickness of deposit which ranges roughly from .0001″ to .001″. The tentative specifications for zinc and cadmium on steel recently issued jointly by The American Electro-platers' Society and the American Society for Testing Materials may serve as a guide in this respect. For mildly corrosive atmospheres, a minimum thickness of 0.00015″ has been tentatively set, and for more severe atmospheres or for general service, 0.0005″. Work in England has shown that in the case of cadmium deposits, above .0003″ the degree of protection increases with thickness faster than below this figure and it is felt that this should be the minimum. For zinc, the thickness tends to run from .0004″ to .001″ and for cadmium from .00025″ to .0005″, depending on service conditions.

C. Determination of Weight and Average Thickness of Deposit

The determination of the weight and average thickness of zinc and cadmium electrodeposits by stripping the metal from a known area is particularly attractive because of the ease of removing the metals from steel without consequential attack of the basis metal. The weight of metal removed can be converted to thickness figures by the use of the following formulae:

$$\text{Aver. thickness of zinc in cm.} = \frac{\text{Loss in wt. (in gms.)} \times 0.14}{\text{Area (in sq. cm.)}}$$

$$\text{Aver. thickness of zinc in inches} = \frac{\text{Loss in wt. (in dwt.)} \times 0.013}{\text{Area (in sq. in.)}}$$

$$\text{Aver. thickness of cadmium in cm.} = \frac{\text{Loss in wt. (in gms.)} \times 0.12}{\text{Area (in sq. cm.)}}$$

$$\text{Aver. thickness of cadmium in inches} = \frac{\text{Loss in wt. (in dwt.)} \times 0.011}{\text{Area (in sq. in.)}}$$

In the case of zinc-coated wire, it is often desirable to express the results in ounces per sq. ft. of stripped wire surface. This can be conveniently done, without even measuring the length of wire stripped, by computation with the following formula:

Ounces of zinc per sq. ft. stripped wire surface $= 163 \times d \times r$

where d = diameter of stripped wire in inches

$$r = \frac{\text{loss in wt. due to stripping}}{\text{weight after stripping}}$$

Of course, the area stripped must previously be thoroughly cleaned, and, after stripping, thoroughly rinsed and dried.

The solutions recommended for stripping are given below.

STRIPPING ZINC OR CADMIUM FROM IRON AND STEEL

(1) The preferred method for stripping these metals from iron and steel and the one described as standard for zinc by the American Society for Testing Materials involves the use of a solution of hydrochloric acid inhibited with antimony chloride. The solution is made as follows:

Antimony chloride solution: Dissolve 20 gms. of antimony trioxide or 32 gms. of antimony trichloride in 1000 cc. of concentrated hydrochloric acid (sp. gr. 1.19).

Strip solution: Add 5 cc. of above antimony chloride solution to 100 cc. of concentrated hydrochloric acid (sp. gr. 1.19). The temperature of the solution during stripping should never exceed 100°F.

The cleaned article is immersed in the above solution and allowed to remain there until evolution of hydrogen gas has ceased or until only a few bubbles are being evolved, which normally requires only about 15 to 30 seconds. The specimen is then washed, scrubbed in running water, and then thoroughly dried before weighing.

Instead of antimony trichloride, gum tragacanth has been mentioned as an inhibitor having the advantage of not leaving a deposit on the steel as the antimony does. It would appear, however, that the latter is still in greatest favor.

(2) Instead of the above solution, the Society describes as an alternate one (for zinc, but it may be used also for cadmium) a 4% sulfuric acid solution (4 cc. of concentrated sulfuric acid, sp. gr. 1.84, in 96 cc. water) used at room temperature. This solution requires 5 to 30 minutes for cessation of rapid evolution of hydrogen gas. Otherwise, the procedure follows exactly the above description.

(3) Another solution for stripping zinc, adopted as an alternative by the American Society for Testing Materials, uses basic lead acetate and is known by that name. The solution contains 400 grams of crystallized lead acetate per liter of water, to which are added four grams of litharge. After thorough agitation, the solution is allowed to settle and the supernatant liquid decanted for use.

In use, the zinc goes into solution precipitating the lead on the iron. Ordinarily, but not always, no trouble is experienced in wiping the lead from the iron, if care is taken to avoid burnishing action.

(4) Instead of weighing the sample before and after stripping in acid and computing the average thickness from the loss in weight, it is possible to judge the thickness by the maximum rise in temperature of the strip solution (concentrated hydrochloric acid), as noted on an accurate thermometer. It is essential that every detail be standardized. To convert temperature rise into thickness figures, it is first necessary to calibrate the apparatus exactly as it is to be used, even using coated specimens of similar size and material. The thickness of the coating on these specimens is determined by one of the other methods described here,

and a table made correlating these known thicknesses with the measured temperature rises.

(5) To avoid destroying the article being tested, when it is necessary to strip only part of it or when it is desired to test only a certain area of a specimen, the hydrogen evolution method may be employed. In this procedure, a cup, connected to a gas burette and leveling bottle, is inverted over the area under consideration and pressed tightly to it. The hydrochloric acid strip solution described above is then admitted to the cup and when the resulting effervescence has ceased, the accumulated gas is transferred to the gas burette, measured, and the results converted to 20°C and atmospheric pressure. Under these condtions, 1 cc. of gas corresponds to 2.72 milligrams of zinc or 4.68 mg. cadmium from which figures and from measurement of the area stripped, the average thickness can be computed by means of the above formulae in the usual way. It is claimed that the results check very closely with those obtained by weighing the article before and after stripping.

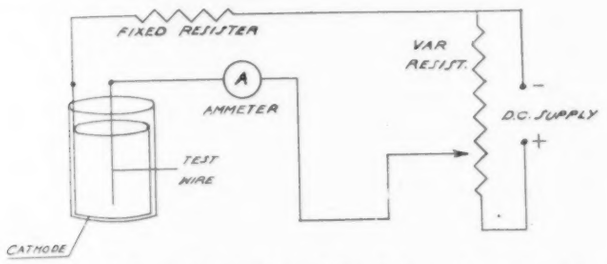


Figure I. Cell and circuit used by Britton for measuring coating thicknesses electrochemically.

(6) Both Glazunov and Britton employ an electrochemical method of determining the "useful thickness" of zinc coated wire, the methods differing essentially only in the composition of the electrolyte used. Glazunov uses a concentrated zinc sulfate solution and Britton a solution of 20 parts sodium chloride and 10 parts zinc sulfate in 100 parts of water. The principle involves measuring the time necessary to strip the coating at constant current.

Britton uses a cell and a circuit as illustrated in Fig. 1. A cylindrical glass jar at least 3″ in diameter and 5″ deep has an Ebonite cap pierced centrally and an Ebonite bottom disc with a central depression of about .05″. Fitting tightly against the inside curved surface is a cathode of perforated zinc and the straightened wire to be tested, at least 6″ long and anodically connected, passes through the pierced Ebonite top and rests in the depression in the bottom disc. Sufficient solution is used to cover 4.0″ of wire. Convenient electrical constants for the circuit are a 110 v D.C. supply, a fixed resistance of 25 ohms, variable resistance around 100 ohms, and a moving coil ammeter with ranges 0-1 and 0-5 amperes.

In operation, the wire is first immersed in a 2% sulfuric acid solution for 15 seconds, wiped with cotton wool, and then put into the cell. A current is applied, being kept constant and corresponding to 1.0 amps. per sq. in. This removes 0.104 oz. of zinc per sq. ft. per minute. (The alloy-layer in hot dipped coatings is removed at substantially the same rate.) After a given interval measured by a stop-watch, the wire is removed, wiped with cotton wool, and immersed in a 10% copper sulfate solution for 5 seconds. If no bright red copper is deposited, the wire is returned to the cell and the above repeated until the copper deposition indicates that the iron has been bared. The total time of stripping multiplied by the factor 0.104 gives the total weight in ounces of the coating per sq. ft. of surface.

Instead of an ammeter, an ampere-hour meter may be used, in which case, the need of keeping the current absolutely constant is not so great. One ampere-hour corresponds to 0.0431 ounces of zinc removal. If, at constant current, the potential difference between the wire and cathode is measured and plotted against time, curves are obtained as illustrated in Fig. 2, giving valuable information about the structure of hot-dipped coatings.

On this curve the time intervals correspond as follows: After a time AB, alloy layer is first exposed, so that AB corresponds to the thickness of the thinnest part of the pure zinc coating. As stripping continues, more and more of the alloy layer is exposed until at C all the pure zinc has disappeared and the surface is entirely zinc-iron alloy. The time interval AC therefore is proportional to the thickness of the thickest part of the pure zinc coating. As the time progresses beyond C, there is no change in potential until the alloy layer is removed at its thinnest part, corresponding to point D, exposing the iron. AD is therefore proportional to the thickness of the thinnest part of the total coating, and CD corresponds to the minimum thickness possible for the alloy layer. As the current is further applied, the potential rises as a greater area of denuded iron appears, until at E, only the bare iron is left and the potential is therefore again constant. The time interval AE is therefore proportional to the thickness of the thickest part of the total coating and BE to the maximum thickness possible for the alloy layer.

Fig. 3 is the type of curve obtained with electrodeposited zinc.

A strip method for thickness similar to the above may also be applied to flat sheets if a proper cell is set up so that the current density on the anode is uniform over the entire area.

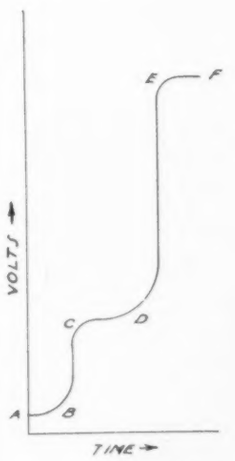


Figure II
Potential-time curve for hot-dipped zinc.

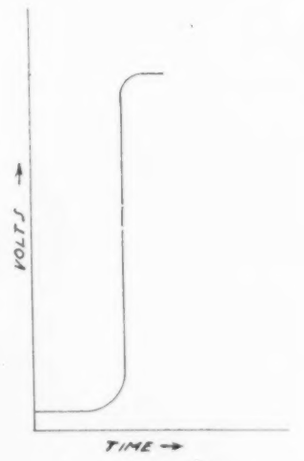


Figure III
Curve with electroplated zinc. (After Britton).

(7) A solution for stripping cadmium from iron and steel contains 120 grams of ammonium nitrate in 1 liter of water, operated at about 100°F. Under these conditions 0.001″ are dissolved in about 10 minutes.

(8) Also for stripping cadmium, there may be used a solution containing 50 grams ammonium persulfate and

100 cc. concentrated ammonium hydroxide (sp. gr. 0.90) in 1 liter of water, used at room temperature. This is much slower than the above, requiring about 1 hour to dissolve 0.001".

It should be noted that in the case of high temperature methods for coating with zinc, such as hot-galvanizing or sherardizing, the only safe way to determine the total weight of zinc is to strip the coating in unused 10% sulfuric acid and analyze the resulting solution for zinc, since the loss in weight includes a certain amount of iron alloyed with the zinc. Unless the deposit is very non-uniform, in which case attack of the iron first exposed must be inhibited, the use of arsenic is not recommended here because it interferes with the determination of iron in later analytical work. It would appear, too, that the actual structure of the coating, i.e. whether the latter is obtained by hot-dipping, electrodeposition, or sherardizing, is far less important, as far as atmospheric corrosion is concerned, than the total thickness of the coating.

STRIPPING ZINC OR CADMIUM FROM COPPER OR ITS ALLOYS

For reasons given above, zinc is rarely deposited on copper. Cadmium is more often used but still with no great frequency as compared with its deposition on iron (steel). It is, therefore, unnecessary to go into detail. Concentrated hydrochloric acid works satisfactorily and the use of antimony chloride as an addition to the acid is neither necessary nor recommended.

D. Stripping from Defective Work for Purposes of Replating

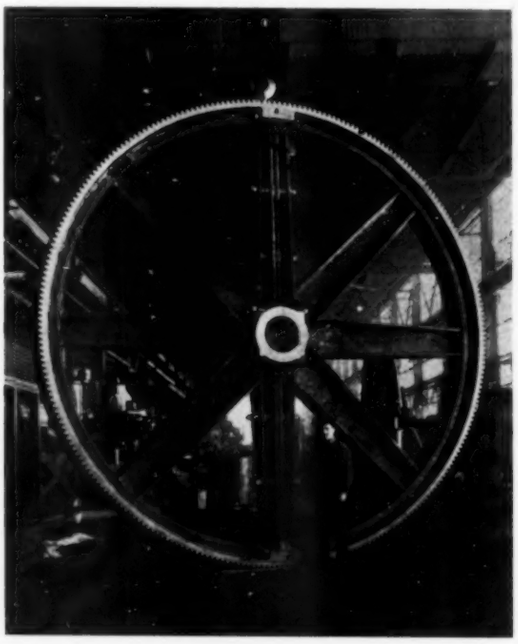
Probably the best solution to use for stripping work prior to replating is the hydrochloric acid-antimony trichloride solution described above. Its action is fast and the attack on the steel at a minimum. The film of antimony which appears on the article after stripping must be carefully and thoroughly removed, however, to avoid subsequent plating difficulties. In stripping from copper or copper alloys, the arsenic may be omitted. Both zinc and cadmium are very soft, and it is therefore often possible and convenient to remove these metals, in the case of simple, small pieces, by buffing and polishing.

E. Testing for Local Thickness. (Distribution of Plate)

Both cadmium and zinc are popularly electroplated from cyanide solutions having good throwing power so that, except in unusual cases, a reasonably good distribution of plate can be expected. This is not meant to belittle the importance of testing for local thickness. First one must consider the fact that platers, when dealing with solutions of high throwing power, are usually less careful in their methods of racking, and articles so plated may, therefore, have no better distribution of deposit than if plated in another solution of lower throwing power, but properly racked. Further, due to the method of rendering protection against corrosion, it is vitally important that the thickness of coating be greater than a certain predetermined minimum if adequate protection is to be secured. This may at first appear strange, since iron, if exposed in places, should still be electrochemically protected from corrosion. Actually, if the exposed area becomes appreciable, the protective influence of the coating cannot extend sufficiently to cover the entire denuded part. Furthermore, in some cases, notably with zinc, the products of corrosion tend to insulate the exposed iron from the zinc, thus further diminishing its protective action. In this sense, therefore, it is more disastrous to have a large area covered only with a thin coating that will soon disappear than to have a very tiny area completely exposed but adjacent to a heavy coating of protective plate.

In the stripping methods described above, some idea of distribution will naturally be secured, but the following tests are designed specifically for determining either local thickness or relative distribution.

(To be continued in the May issue.)



The Farrel-Sykes continuous tooth herringbone gear, shown in the accompanying illustration, is over 18 *feet in outside diameter, with a* 25*-inch face. The total weight of the two steel castings from which the gear is made is* 44,900 *lbs. The two halves are carefully machined and bolted together with fitted bolts. The teeth are accurately generated by the Sykes process. The gear was made for driving a rolling mill and it transmits* 800 *H.P. at* 360 *R.P.M.*

(Courtesy of Farrel-Birmingham Co., Inc., Ansonia, Conn.)

PLATING AND FINISHING
FABRICATION — ASSEMBLING
METALLURGICAL — ROLLING
CASTING AND JOINING

SHOP PROBLEMS

Technical Advisors For April Issue

G. BYRON HOGABOOM
Consultant in Electroplating and Metal Finishing, Newark, N. J.

FRED A. KELM
Consultant on Finishing Jersey City, N. J.

DR. GUSTAVE KLINKENSTEIN
Vice President Maas & Waldstein Co. Newark, N. J.

JOSEPH P. SEXTON
Superintendent of Plating and Finishing Sargent & Company, New Haven, Conn.

When sending solutions for analysis please give following information: name and address; class of work being plated; kind of solution and volume; length, width and depth of tank; temperature of solution; current density, cleaning sequence and any other pertinent facts.

Full information is necessary in order to render proper service.

Bower Barff Finish On Cast Iron

Q. Will you please give me information on the Bower Barff process of treating cast iron and steel pieces? I cannot locate this information in the technical books which are available.

A. There are many ways of imitating the Bower Barff finish on steel and cast iron articles by plating, oxidizing, etc., but the original Bower Barff finish is a heat treating process.

The articles are first sand-blasted, but in many cases, the cast iron parts are polished before sand-blasting. They are then coated with black iron oxide, mixed with a suitable oil such as linseed, wiped dry, and baked at about 1450°F, alternating gas, and gas and air for about 2 hours. After this, the articles are again coated and wiped dry, using a mixture of black oxide of iron, lamp-black and tallow.

A dead black lacquer could be used instead for color, and in fact this lacquer coating over any metals that have been previously sand-blasted, makes a very good color substitute for the Bower Barff finish.—J.P.S.

Marblized Lacquer Effects

Q. We have under consideration a process for making a marblized effect on lacquer enamel work. In connection with this, it is desirable to find a method of applying green and ochre shades by means of fumes or smoke.

Can you give us any advice as to what method we could use to produce fumes or smoke which, when settling upon the enameled surface, would produce these colors, and at the same time would not be injurious to the surface or to the workers employed in carrying out the process?

A. I do not know of any method of fuming green and ochre shades on the surface of an object to produce a marblized effect. There are two general methods for doing this work:

No. 1 is the use of a so-called veiling lacquer which forms webs or fine strings as it leaves the spray gun and then settles upon the surface giving the effect of a webbed or marblized surface. The veiling lacquer is applied over a suitable colored background and is followed by gloss lacquer for further protection.

No. 2 is the use of so-called float enamels. By this method, suitable lacquer base colors or oil base colors are floated on the surface of water. The object to be finished is first coated with a suitable ground-coat color, allowed to dry. It is then dipped into the water having a thin coat of the float enamels on the surface. It is brought out with an upward and side motion to give a wavy effect. As many colors as desired may be carried on the surface in this manner. The float colors are then protected by top-coat lacquer.—G. K.

Mirror Finishing of Knife Blades

Q. Will you please give us data concerning mirror finishing on steel knife blades?

A. The mirror finish is produced by polishing with No. 220 or No. 240 emery on a grease wheel and then glazing in one of three ways. For small production, the knives are buffed on a muslin wheel using a stainless steel buffing composition. For increased production, a glazing machine is often used, and for mass production, the knives are finished between felt rolls on a special knife buffing machine.—G. B. H., Jr.

Chromium Plating on Brass

Q. I am trying to get some information relative to the durability of articles finished with a chromium plate deposited directly upon brass or bronze. I understand a lot of commercial plating is being done where the chromium is plated directly upon these metals, and I would like to know what

information you have on this procedure as compared to the plating of chromium over a nickel plated surface, that is, plating nickel directly upon the bronze and then putting chromium on top of the nickel.

A. The finishing of brass or bronze by simply plating chromium direct is not advisable if a durable finish is desired.

A fairly good chromium deposit will be in the neighborhood of only .00002" thick. Such a thin deposit is very porous and the metal beneath the deposit will tarnish through the plate. Thus if a chromium plated brass article is allowed to stand under outdoor exposure, it will take on a brassy-looking tarnish in a few weeks.

About the only place where chromium direct on brass or bronze is advisable, is on the mildest kind of indoor service. Even this is open to question, and it is known that a large installation of building hardware which was chromium plated directly upon brass had to be taken off and refinished. Similar unpleasant occurrences have taken place on plumbing goods.

Your mentioning of nickel directly on bronze can be done but it is better to first cyanide copper flash bronze before nickel plating. In this way, the lead and any other points on the surface not readily covered by nickel, will receive a copper deposit which can be more completely covered with the nickel.—G. B. H., Jr.

Barrel Plating

Q. 1. Is it true that the amount of salts for cyanide copper barrel plating must be double the quantities used for still plating and does the same hold good for nickel?

2. Does sodium carbonate being added as a replenisher to copper cyanide solution have any tendency to build up the sodium cyanide content?

3. Every time I add hydrogen peroxide to the nickel plating bath, on the week-end, the pH rises from 5.8 to 6.4. What makes the pH rise in this case?

4. What is a good undercoating other than paraffin wax when one is doing novelty plating on wood or other non-metallics?

A. I am of the opinion that many of the baths used for barrel plating are made unnecessarily too concentrated. The current densities used in barrel plating are not high, and for example in barrel nickel plating, current densities above 5 amperes per sq. ft. are seldom obtained. The reason for using solutions more concentrated than those used for still plating is that in cases where the perforations in the barrels are small there is not sufficient circulation between the solution in the barrel and that in the tank itself and, therefore, higher concentrations of salts give a greater reservoir for metal which is being depleted. However, if the holes in the barrel are relatively large (more than 3/16" in diameter) the solutions need only be about 25% greater in concentration than those used for still plating. The increased concentration is advisable due to the fact that the drag-out loss in barrel plating is usually higher than that in still plating. I know of many barrel baths which are operated with concentrations only slightly higher than those used in still plating giving excellent results, but because additions are made at relatively short intervals (every four to six hours).

2. The addition of sodium carbonate will have no influence on the sodium cyanide content.

3. The only explanation which I can offer regarding the increase in pH due to the addition of hydrogen peroxide, is that you are getting stratification of your solution and the stirring of the solution would naturally give a different pH. To check this, stir the solution on Friday without adding the hydrogen peroxide and see whether the pH rises.

4. Wax is not a good undercoating for plating on non-metallics due to its low melting point and also due to the fact that it does not hold the copper powder very tenaciously. Slow drying varnishes or even shellac will be found more suitable.—W. R. M.

Etched Finish

Q. I would like to know how to produce the finish on the escutcheon sent you, which appears to be an etched type of finish.

A. Your sample, being a brass casting, the following practical and quickest way would be to polish brass highly, then clean in a mild metal cleaner so that all traces of grease are removed, then dry.

Now take asphaltum, spread very thinly on a piece of glass. Break off a fine piece of sponge that has odd designs on its surface, dip gently into the asphaltum so that only the design on the sponge is wet, stipple gently on the polished casting so that the markings show oddly on the metal. When entirely covered, dry in oven and then prepare an etching solution which is good on copper, brass or tombac metal. (Pure nitric acid diluted with water to 18° Bé.)

While etching, keep work agitated so as to prevent gas bubbles from forming on work. This etching solution works quickly and in doing work, you can time etching from ½ minute to 2 minutes.

After the work comes from the etching solution, it is dipped into turpentine or thinner to remove asphaltum. Now color up work lightly and background will remain dull, then proceed with nickel and chromium finish.

F.A.K.

Nickel Plating on Stainless Steel

Q. Will you please recommend a process for nickel and chromium plating on stainless steel?

A. For a good method of plating upon stainless steel, read the article by Donald Wood in the July 1938 issue of Metal Industry, page 330.

This method is similar to many suggestions for plating upon stainless steel, that is, the solution used is, in reality, a strike with a high acid content. Under electrolysis, this results in a copious evolution of hydrogen, which activates the surface of the cathode, and a slight deposition of metal occurs so that a base is produced to take a subsequent deposit.

The Piersol process, U. S. patent 1,774,901, consists in hanging the work to be plated in the chromium tank and then short circuiting the anode and cathode bars (no current on). Evidently a galvanic cell is set up and the stainless steel is activated. Then the short is removed and the plating current turned on.

Joseph Haas and Elmer Unrich (Metal Industry 23, pp. 451-452, 1925) found that for plating upon stainless steel, a surface treatment by making the work cathodic in concentrated hydrochloric acid gave good results.

G. B. H., Jr.

METALLURGICAL DIGEST

SELECTED ABSTRACTS ON CASTING—ROLLING—PHYSICAL METALLURGY

Tarnish Films on Copper. By J. B. Dyess and H. A. Miley. American Institute of Mining & Metallurgical Engineers. Technical Publication No. 1008.

The electrical method of measuring film thickness was used to measure tarnish films on copper when they were mixtures of cuprous oxide, cupric oxide and cuprous sulphide.

Copper sulphide films are shown to have approximately the same thickness values as copper oxide films of the same colors and orders.

Mixtures of oxide and sulphide films giving uniform tints were found to have total thickness values consistent with the values for oxide films of similar colors.

Previous electrical measurements of the rapid formation of invisible oxide films at ordinary temperatures were confirmed.

When oxide-coated copper was exposed to moist hydrogen sulphide in air, copper sulphide was formed: (1) by combining some sulphur with copper from the base metal, and (2) by replacing some oxygen from the oxides by sulphur.

No evidence was obtained of the replacement of sulphur by oxygen, even when the sulphide films were subjected to oxidation treatment in an electric furnace.

Thin oxide films containing pores and thick ones with cracks gave less protection against severe attacks of moist hydrogen sulphide in air than films of the intermediate thickness range. This range of greatest protection was found to be approximately 125 to 275A, the thickness giving maximum protection occurring at about 200A.

It was observed that sulphide films gave more protection against severe attacks of moist hydrogen sulphide in air than oxide films of equal thicknesses.

The authors gave some of their views concerning the mechanism of the tarnishing of copper by moist hydrogen sulphide in air.

The Effect of Composition and Constitution on the Working and on Some Physical Properties of the Tin Bronzes. By R. Chadwick. J. Inst. Metals, 1939, 64 (Advance copy).

A systematic study has been made of the working properties of the cast tin bronzes containing up to 30% tin, both pure and with additions of 0.1% and 0.5% phosphorus. Where possible, alloys were fabricated into strip, and the properties of representative alloys determined.

The casting of many of the alloys was difficult, owing to the liability to severe segregation in the ingots produced. Special precautions were taken to avoid contacts with reducing gases at all stages, and in addition, the gas content of the copper was reduced by oxidation. The small castings required for the work were free from appreciable segregation.

Small cylinders of each alloy were forged over a full range of temperatures, and the amounts of cracking were compared. Contours showing the amount of cracking on a temperature-composition diagram showed the presence of tough regions which could be used for fabricating the alloys.

The alloys were rolled at the most suitable temperature, down to 0.020" strip. In the case of alloys rolled below recrystallization temperature, alternate rolling and annealing was employed. Other alloys were hot-rolled. Alloys containing from 17% to 19% tin, and those containing more than 25% tin, could not be fabricated into thin strip.

The equilibrium of the ternary copper-tin-phosphorous alloys with up to 25% tin and up to 1% phosphorus was determined at 600°C., micro-examination being carried out on 0.050" strip. The alpha phase boundary was shown to extend from 15.4% tin in the pure alloy to 13% tin with 0.3% phosphorus. Phosphorus solubility showed a minimum of about 0.3% at about 14% tin content.

A general micro-examination was made of all alloys quenched from temperatures representative of the various phase fields in the copper-tin diagram. No marked modification of structures was obtained as a result of phosphorus additions up to the amount in which free phosphide appeared.

Tough strip was only obtained from the alpha beta and gamma phases, the lower temperature phases being brittle. Phosphide in the maximum amounts present did not affect physical properties. Micrographs of strip in the various tough conditions are illustrated.

Work-hardening by cold-rolling, tensile strength in the soft and hard-rolled conditions, and also hardnesses have been determined on a number of typical alloys covering the whole range of tough materials prepared. The examination of alloys near the alpha phase boundary, i.e., those containing 13-16% tin, has been made in greater detail. These alloys gave the maximum strength obtainable in the series.

Embrittlement of Tin at Elevated Temperatures and Its Relation to Impurities. By C. E. Homer and H. Plummer. J. Inst. Metals, 1939, 64 (Advance copy).

The embrittlement of tin at elevated temperatures is not a property of the pure metal but is caused by the presence of impurities. The latter form eutectics or solid solutions which fuse at temperatures below the melting point of tin, and thus lead to intergranular fracture. By means of a simple bending test, the temperature at which brittleness first occurs has been determined for both cast and annealed specimens of tin containing additions of lead, copper, bismuth, cadmium, silver, zinc, iron, antimony or arsenic. In each case, the temperatures may be correlated with the solidus of the equilibrium diagram and it is shown that in many cases the method may be employed to determine the solidus lines quickly and accurately. Solidus lines have been determined in this manner for the tin ends of the systems lead-tin, copper-tin, cadmium-tin, silver-tin, and zinc-tin, and certain new values are given for limits of solid solubility. The effects of adding two or more impurities simultaneously to tin have been investigated. A study has been made of the distribution of lead in tin and of the rate and manner of dissolution and re-precipitation of the lead-tin eutectic on heating and cooling certain tin-rich alloys. The Brinell hardness of pure tin has been determined over a range of temperature between 0°C. and the melting point, and the curve shows no inflections. The existing information on the supposed gamma modification of tin is reviewed in the light of the present results. It is concluded that this modification does not exist, and that many of the effects previously ascribed to it have been caused by impurities.

Studies upon the Corrosion of Tin, II—The Effects of Other Anions in Carbonate Solutions. By Gerhard Derge and Harold Markus. American Institute of Mining & Metallurgical Engineers, Technical Publication No. 991.

There are some rather striking observations to be made from the data given in this paper. It is generally known that tin is corroded in alkaline solutions, whereas it is comparatively resistant to corrosion in nearly neutral solutions. However, it is significant that in carbonate solutions, small amounts of foreign anions all tend to lessen this corrosion tendency, or at least have no deleterious effects, if the pH can be kept below 9.5. Experiments in nearly neutral solutions of 0.1 M alkali salts of a large number of acids led T. P. Hoar to the same conclusion, though his conditions were somewhat different because he studied the salts individually rather than in the presence of carbonate. At a pH of about 10.0, the foreign anions have a very slight effect, except phosphate, perborate and chromate. This indicates that some attention to the pH of carbonate products should lengthen package life, and that often harmless additions of some anion can be made that will actually afford a large measure of protection. These studies indicate that protective films may be formed in halide, chromate, perborate and phosphate solutions, and further experiments investigating the possibilities of these films are now in progress.

ELECTROPLATING DIGEST

SELECTED ABSTRACTS ON PLATING—F'NISHING—RUST PROOFING—LACQUERING

A Resume of Platinum Plating

By Joseph B. Kushner

Monocraft Products, New York, N. Y.

(The first portion of this article appeared in the March issue).

In electrolysis, the inert part of the platinum compound escapes into the atmosphere as a gas, thus additions of "P" salt do not build up the bath in harmful salts. This is a distinct advantage over type (3) bath. Here is a typical formula as given by Schumpelt[11]:

Platinum (as di-nitro diammino platinum, sometimes called by its trade name, platmum "P" salt)	10 grams
Ammonium nitrate	100 grams
Sodium nitrite	10 grams

All dissolved in a liter of distilled water containing 50 ccs. of ammonia (specific gravity 0.88).

Temperature 90°C. Voltage 2-6; Cathode efficiency, 10%. Replenish with daily additions of "P" salt and ammonia. For heavy deposits, lower current densities should be used and the deposits should be scratch-brushed at intervals to get easier coloring.

(5) THE HYDROXYL BATHS (1931-present day)

This type of bath in which the platinum is combined in a complex with hydroxyl ions was first patented by Powell[12] and his co-workers in 1931. A formula[13] described at the First International Conference on Electro-deposition is as follows:

Sodium hexahydroxyplatinate ($Na_2Pt(OH)_6 \cdot 2H_2O$)	18.5 grams/liter
Sodium hydroxide	5.1 grams/liter
Sodium oxalate	5.1 grams/liter
Sodium sulphate (anhydrous)	30.8 grams/liter

Temperature 65°-80°C. Voltage 1-6. Current density 7.5 amps. per sq. ft. Cathode efficiency almost 100%. Cathodes, platinum or platinum plated copper (at least 2 grams of platinum per sq. ft.). Replenish the bath with daily additions of platinum salt to keep the platinum content from 0.7 to 1% and add about 0.22 grams of NaOH per liter of solution every day starting from the 2nd week after continual use of the bath. Below 0.7% platinum content, the throwing power falls off. After a while, carbonates may build up in the bath due to the reaction of the sodium hydroxide in the solution with atmospheric carbon dioxide. These can be removed by the addition of sulphuric acid precipitating an insoluble platinum compound which is filtered off and redissolved in fresh caustic soda to make up a new bath.

The best basis metals for deposits from this type of bath, or all platinum baths for that matter, are the karat golds, sterling silver, electrodeposited silver, copper and brass. Other base metals must be preplated with copper or silver. After plating, rinse the cathode in boiling hot water for about 15 minutes, then dry (preferably in a hot air oven). The plate will be bright but may show some water spots or "bloom". Buffing with a soft buff and fine rouge will give a brilliant finish.

Other types of electrolytes[14], such as the cyanides have been proposed but it has been shown by Grube[15] and his co-workers that platinum in cyanide form gives no deposits on any type of cathode but mercury. However, patents[16] have been granted as recently as 1935 on baths containing the platino cyanides.

All of the foregoing types of plating baths with the exception of type (5) were evaluated in a series of careful experiments by Grube, who found that (3) and (4) were best, with (4) being somewhat superior due to the fact that replenishment of bath (3) resulted in building up the bath with accumulations of inert salts and chlorides, whereas in the nitrite bath, no such effect is experienced as it decomposes in use with the evolution of ammonia and nitric oxide.

Atkinson[17] found the hydroxyl type of bath excellent in use but noticed a slight tendency towards decomposition on long standing.

Weisberg[19] experimented with the hydroxyl type of bath and obtained brilliant deposits of platinum. The metal deposited from this bath proved to be exceptionally hard and it was asserted that when platinum plated silver spoons and rhodium plated spoons were compared, it was found that the platinum coated spoons were more resistant to abrasion and wear. It is claimed that plates from this type of solution are relatively free from pinholes and cracks. However, unless the bath is used constantly, there is a marked tendency towards excess carbonate formation, which destroys its excellent plating properties. The electrolyte is somewhat sensitive to slight changes in concentration of both metal and salts, with insufficient latitude in operation.

The writer has found the following bath, of the complex nitrite type, recommended by Keitel[20], to give good results.

Platinum di-ammino nitrite	5 grams
Phosphoric acid (85%)	80 ccs.
Water	To make one liter

Temperature of operation 140°F. Voltage 2½.

For those interested in a further study of platinum plating, the writer recommends the extensive bibliography of Mellor[18] which lists over 100 references to the literature and the recent work of Atkinson.

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Post Scripts

It has been claimed that the word *hoax* came into our language as a result of a wager by one John Doe that he could add a new word to the English language. He plastered the word all over town and because of the bewilderment of the people as to its meaning, the word has come to mean a practical joke. I am beginning to wonder whether the word "herbimium" is not in this category. After receiving several inquiries about herbimium plating, we turned to *Dr. Blum* of the Bureau of Standards for an explanation and his reply was as follows:

"In reply to your letter of March 3rd, I would state that we have never heard of 'herbimium' plating."

Will the people who invented "herbimium" plating please enlighten us?

• •

Jack Geissman, Dan Wittig, Bob Steuernagel, Henry Bornitzke and the rest of the Milwaukee Branch's annual convention committee, have lined up a sure-fire program for their meeting April 29. And have you heard? *Heinie and his Grenadiers* will play at the dance.—This and Milwaukee Gemutlichkeit should give anyone nostalgia for Milwaukee.

• •

Cyril Kocour of Chicago recently joined the ranks of the A.E.S. members who vacation in Florida. *Charlie Proctor* should be able to form a Florida A.E.S. branch soon.

• •

The new *Plating and Finishing Guidebook* will be off the press this month and you will find it completely revised. We have had the assistance of over a dozen experts of the industry in preparing the technical articles. It will have to be good to match the previous efforts of *Oliver J. Sizelove* and Messrs. *G. B. Hogaboom, Jr.*, and *Thomas Chamberlain*. Hope you like it.

• •

Complaints have reached us from the Mid-West and Far-West that we favor the East in news items—'Taint so—it's just so much more difficult gathering news from way out there—will try to fix.

• •

"Folks", said the colored minister, "the subject of my sermon dis evenin' am 'Liars'. How many in de congregation has read the sixty-ninth chapter of Matthew?"

Nearly every hand in the audience was raised immediately!

"Dat's right", said his reverence, "you is just de folks I want to preach to. Dere is no sixty-ninth chapter of Matthew"—Bindery Talk.

• •

Henry Painter sent in the following formula of a dip for producing a brass color on steel which he found in an old "Monthly Review."

Copper sulfate	3 ozs.
Tin chloride	1½ ozs.
Sulfuric acid	1½ ozs.

Use at room temperature.

• •

On March 24, ye editor was the guest of *Fred Fulforth* in Philadelphia preceding a talk to an A.E.S. open meeting. Fred showed us how proper selection and handling of steel leads to better and cheaper finishes and we are pleased to state that Fred has prepared an excellent paper on the subject which will appear in the June issue of Metal Industry.—It was gratifying to see at the educational session such prominent men in the audience as: *Dr. Ken Graham, Joseph Underwood, A. M. Robson, E. J. Zurbach, Jr., L. A. Critchfield, Clayton Hoff, LeRoy Beaver, Dr. H. J. Read* and *George Gehling*.

On Saturday, the editor was the guest of *Clayton Hoff*, DuPont electrochemist, in the vicinity of Wilmington, Dela., plus or minus 100 miles, on an ornithological safari (bird hunt). *Cedric Vincent-Davies* who is famous for his color photography and especially the color pictures of the corrosion test panels of the A.E.S. research on corrosion, was official photographer and we hope to show more of his art in the May issue. 49 birds were observed in the woods of Delaware and Maryland on the inlets of Chesapeake Bay, thanks to the sharp eyes and expert knowledge of Clayton Hoff. Ye editor was saved some embarrassment when Clayton informed me that a group of ducks I was stalking were just wooden decoys. Cedric, however, won the *faux pas* award by carefully stalking a Canada goose and taking its photograph only to find out later that it was a tame goose!

• •

Bryce Denton of Ontario, California visited Bridgeport recently to attend an A.E.S. meeting as a guest of *Joseph Sterling*, G. E. foreman.

Clayton Hoff (standing) and the editor (looking through the telescope) watching some loons and ring-necked ducks out in a branch of Chesapeake Bay. Photograph by C. Vincent-Davies.

Notes Gathered in Boston

Harry Lack of Gillette Safety Razor Co., Boston, in company with *James O'Brien*, Monocraft Products Co., Providence, R. I. was in attendance at *Dave X. Clarin's* spa listening to Dave's never-ending supply of anecdotal matter. Harry said he had his snow-white hair ever since he was 19 years old. Harry started in the plating business in 1899 in Oakland, California, plating silverware for the Southern Pacific and Union Pacific R. R.—His youthful peregrinations started when his father refused to let him play baseball. He has a son at the Bureau of Standards who has degrees from Princeton and University of Pennsylvania.

Louis M. Gale also of Gillette Safety Razor

Co. is now keeping a careful eye on his son's school report card. His son slipped a little recently in his studies and was reluctant to show his report card to his father. He waited until his dad was just waking up from a sleep to ask him to sign the report card thinking Gale, Senior would be a little groggy and would sign it without observing the departure from his usual high standards. Dad, however, was not caught napping and it is rumored that Gale, Junior has been burning mid-night oil.

Dr. William Blum and Dr. C. B. F. Young snapped by Nate Hall at N. Y.-Newark meeting. Note the extreme interest of Dr. Young.

Frank Clark, Philip Sievering, Louis Gale, Andrew Garrett and *Francis Mackie* gave short talks at the Educational Session. Francis Mackie said he used chromic acid over 20 years ago but didn't know it could be used for plating. He did find out, however, that you shouldn't mix chromic acid and muriatic acid. Mackie slyly intimated that it wasn't necessary to go to college in Boston, and all that was necessary for erudition is to be born there.

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The educational session was certainly colorful—*George Hogaboom* spoke on coloring of metals and showed beautiful exhibits of colored finishes, and *Dr. Klinkenstein*, not to be out done, illustrated the latest developments in colored organic coatings—wrinkle—crinkle—and crackle finishes.

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The all-girl orchestra provided the usual high quality entertainment so characteristic of the Boston meetings and it also created special interest for several lonesome Springfield natives.

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New York City natives still amaze me. To a small town native, Gothamites are certainly incongruous — the out-of-town "hicks" gaze up at the sky-scrapers and stare at the art treasures, but not the city restdent—he rushes from subway to office, at noon gobbles his lunch and then promenades in a crowd akin to a football crowd panic. At this time the "sidewalk superintending" or "gawking" is exercised in full glory. Pitchmen and sidewalk salesmen draw audiences that would be the envy of any Hyde Park evangelist—a loquacious inebriate can command the attention of a demigogue—but when it comes to really attracting attention, something important like two automobiles with locked bumpers or some poor devil who has lost his keys and is trying to open his car, will draw crowds equivalent to a 4-alarm fire in Kalamazoo or Kokomo. I have long wondered what would happen if *Lady Godiva* should ride through town on her white horse.

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Add the *Yeamans* families to the growing list of three generations in the plating industry. Their records are:

John F. Yeamans, Sr.
1879-1934 (55 yrs.) in plating industry.
Two Sons
W. T. Yeamans
1903-1937 (34 years)
John F. Yeamans, Jr.
1906-1939 (33 years)
W. H. Yeamans (son of W. T.)
1932-1939

All these platers are alive and in good health.

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Sylvester P. Gartland, one of the veteran platers in the business today, was born at Canandaigua, New York in 1873. He began his plating career in 1890, with the C. T. Hamm Co. at Rochester, N. Y. Since the manufacture of bicycles was at its height in the "Nineties" this seemed to be the logical business for a young plater, so in 1894 he entered the employ of a firm manufacturing bicycle saddles. The next few years he travelled through the Mid-west working for several bicycle manufacturers.

Later he returned to Rochester, and in 1903 took over the plating of Eastman camera parts. After a brief stay with this business, which was at this time an infant among industries, Mr. Gartland accepted a position as Foreman Plater with the Taylor Instrument Company, another Rochester concern. During his fourteen years of employment with this company, he furthered his plating knowledge by completing a course in chemistry at Mechanics Institute.

Sylvester P. Gartland

In 1912, he became a charter member of the Rochester Branch of the National Electro-Platers' Society. He still holds the certificate which he received upon initiation into the Society among his prized possessions. His membership in the A.E.S. has been continuous for twenty-seven years. During this time he has held several offices in the Rochester Branch and has been active in the annual conventions for many years. In 1920, the delegates to the Rochester Convention elected him Supreme President, and in this position he presided over the Indianapolis Convention in 1921. In 1921 he assumed the supervision of plating and finishing for the North East Electric Company, a Rochester concern. When the General Motors Corporation absorbed this company in 1929, he continued his position in their employ. In 1937 when General Motors built their new and enlarged plant in Rochester for the manufacture of automobile accessories, Mr. Gartland was transferred to the new plant as Foreman Electroplater, the position he now holds.

During his forty-nine years in the plating business and twenty-seven in the A.E.S. he has made numerous life long friendships. He has contributed generously of his experience to aid his fellow members and is always willing to assist his associates whenever possible.

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IT HAPPENED IN BOSTON

A One Act Playlet

Dramatis Personae:
Wesley Cassel, an inn-keeper
Arthur Collins, a depositor of metals
Ed. Jevelli, a plating lackey
W. A. Sellon, ditto.
Harry Bridgham, ditto.
Miscellaneous bellboys, one-eyed Connelleys and a *stranger*.

Scene: A room in Hotel Bradford, Beantown.

Enter *Arthur Collins*, and a stranger. Alarums and flourishes—

Cassel: Welcome brothers—what'll it be—root beer or ginger ale.

Collins: Neither, I'll take milk.

Jevelli: Same.

Sellon, McAdams, et al: Likewise.

All: Down the hatch.

Stranger: Shay, I mean say, I wanna tell ya about the greatest thing in plating history—rubber anodes. (Laughter)

Bridgham (aside): Another screwball!

Stranger: Yes, they laughed at Pasteur, Marconi and Newton—(hic)—but gentlemen I am about to tell you about an anode development that will be a milestone in electroplating,—rubber anodes,—save 150% on cost of anodes,—you can throw your old anodes away—in fact after you use my rubber anodes you'll have to throw your solution away.

Cassel: Gentlemen, he's got something there.

Collins: Hear, hear!

The stranger gazed around the room and with a manner of a pedantic college professor gave a serious lecture on rubber anodes that was a model of didactics and which held his audience spellbound. When his spell-binding was at an end he left the room. At last the silence was broken.

McAdams: Tell me, who the h— was that fellow, he spouted plating as if he was Blum and Hogaboom rolled into one.

Collins: Oh, that fellow—he's just a coffee salesman who's had a few scotch and sodas.

Cassel—Jevelli—Sellon—Bridgham and ensemble: Well I'll be d—ed! Make mine a scotch and soda.

Finis.

Walter R. Meyer

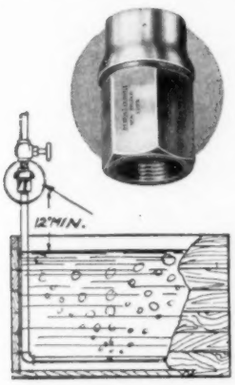
NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

Syphon Breaker and Agitator

The Beaton & Caldwell Mfg. Co., New Britain, Conn., have announced the development of a new syphon breaker and agitator called Caldwell No. 115.

This device is constructed entirely of brass and is built on a Venturi principle which allows water to pass through a restricted orifice, and at the same time admit air. The principle is to force a fresh, clean supply of water into the cleansing tanks that are used in all plating solutions. Water and air enter at the bottom and the acids or other foreign matter which are washed from the material that is being cleaned, will flow off the top of the tank.



This new device is claimed to entirely eliminate cross-syphonage. Considerable water saving is claimed for the use of this device, due to the admittance of air and water, thus making necessary a smaller quantity of water than is normally used.

Radiant Energy Dryer

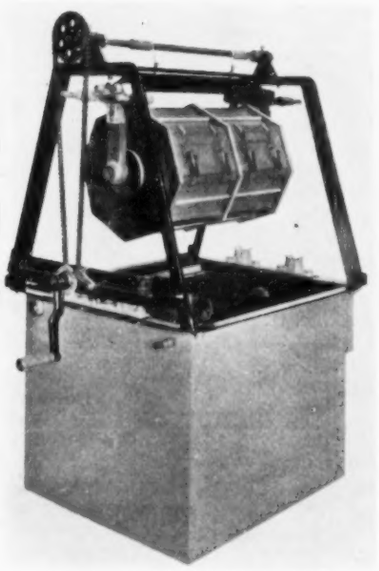
The Edwin F. Guth Co., 2615 Washington Ave., St. Louis, Mo., manufacturers of lighting equipment, have developed a line of Alzak aluminum reflectors to be used with 250 watt drying bulbs.

The reflectors are of the concentrating and spread beam types. Alzak reflectors are said to be heat-proof, non-tarnishable and efficient in reflectivity.

Radiant energy drying has been used in the accelerating of the drying of paint or enamels on automobile bodies and other objects where local radiant heat can be advantageously applied.

Hand-Operated Plating Barrel Hoist

An improvement in plating barrel construction is claimed to have been recently perfected in the form of the Mercil hand operated hoist for single cylinder plating barrels, made by the Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electroplating equipment and supplies. This type of hoist which is very simple and inexpensive, consists of an iron framework, on top of which are two brackets with bronze bushings carrying a 1¼" shaft. A ¼" wire cable is wound around this shaft at one end of which is a ⅝" pitch, 36 tooth sprocket connected to a 12 tooth sprocket at the lower end, with a ⅝" pitch roller chain.



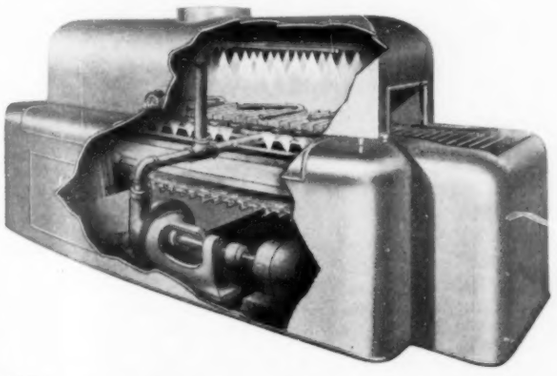
The 12 tooth sprocket is mounted in a 1¼" shaft which carries the ratchet and crank handle and also runs in a bronze bearing. It is possible to reverse the position of the crank handle to the opposite side of the tank as the parts involved are removable and arranged for assembly on either side of the framework. There is a 3 to 1 ratio which requires about 15 turns to lift a 14" diameter barrel and about 17 turns for lifting a 20" barrel.

Spray Washing Machine

The International Conveyor & Washer Corp., Detroit, Mich., have perfected a line of spray washers as illustrated in the accompanying cut.

These washers are claimed to have the following features: a pressure pump of rugged and efficient construction; dirt catching screens, which are removable for quick cleaning; piping and nozzles located to insure thorough cleansing of all surfaces; the solution tank storage capacity of the machine is three times the volume pumped per minute; the conveyor may be designed to carry any shape or size of material and variable speeds may be had on a conveyor drive to synchronize conveyor production; dial faced thermometers for checking temperature of solution in the tank; welded fittings are used for all water, steam or gas and drain connections.

Sizes of the washers may vary from a size for basket cleaning of small parts to the washing of a complete automobile body.



Phanton view of spray washer showing sprays, pumps end conveyor.

PRACTICAL UP-TO-DATE POLISHING

By J. F. Siefen

J. J. Siefen Co., Detroit, Michigan

The introduction of chromium plating for production work in 1927 started a period of better polishing. Several factors added to the need of better polishing as well as chromium plating. One of these is bright nickel. Another is specification plating (a better polished surface prior to plating gives better rustproofing). Then, too, no industry stands still. Better steel, permanent-mold castings, die castings and better dies for stamped parts have furnished the polishing room with metal that needed less polishing but at the same time required a more nearly perfect finish. In most cases, work had to be done at a lower price to keep up with the trend of other finishes. Paint and lacquer have been improved and an entirely new product, plastics, has competed with plated metal for ornamental work.

Better polishing was not accomplished overnight by every shop but has been the result of patient research as well as practical "fit and try" methods. The materials for polishing have progressed accordingly, until today, polishing wheels stand up longer and cut faster as well as give a better finish. The past ten years have seen many changes.

Grain Fracture

The most important changes have been in adhesives and grain. It is a well-known fact that when pressure is applied to a polishing wheel by a piece of work, the grains fracture and present new cutting surfaces. The smaller the amount of grain that fractures from an individual grain, the longer the set-up lasts. In fact, when a polisher produces dust from his wheel instead of large particles, you can be sure he is obtaining the maximum efficiency from his wheel. This dust is a mixture of metal and small pieces of grain.

The abrasive manufacturers have spent considerable time and money producing a proper grain and have succeeded, in recent years, in obtaining remarkable grains that fracture at the proper rate; but unless the head of the polishing wheel is set up properly, all the efforts of the abrasive manufacturers are futile. The grain must be held in a manner that will allow it to do its work most efficiently and give the wheel greatest durability.

Hardness of Adhesive

This means using an adhesive that is neither too soft nor too hard. If an adhesive is too soft, the pressure of the work and the heat generated by the polishing operation bury the grain into the adhesive and stop this fracture. Glazing occurs, the grain is rubbed off and the wheel must be reset. This is done after repeated efforts by the polisher to "open" his wheel with pumice.

If the adhesive is too hard, the coating on the grain prevents the fracture. Glazing also occurs here and cutting stops. Nothing can be done but to reset the wheel. This eventually leads to a building up of a thick head of grain. Then the head must be trimmed off and the wheel resized. As every polisher knows, this produces the effect of a new wheel and it is impossible to obtain the required amount of work from it until it has been reset three or four times.

Another requisite of polishing wheels is flexibility. This is necessary in a wheel to provide the proper fracture of grain as well as to give cushion to the work. The very nature of most polishing makes this flexible head a necessity and this means having the right kind of wheel as well as the right adhesive. If the wrong adhesive is used on the proper wheel, much time and money is wasted.

It is necessary, therefore, that an adhesive and a grain that allow the proper rate of cut and fracture for a specific job, be the most ideal to use. Both adhesive and grain must work hand in hand if best results are to be obtained. Each job is different. Work that has edges and holes which tend to knock off particles of grain is different than work that is flat and smooth. Experienced polishers are very particular when they ask for certain types of wheels. Why not then, use the grain and adhesive which work best with the right wheel?

A New Abrasive Cement

Most fine finish work has been accomplished by a decrease in size of grain. Sometimes this has been done without additional operations, since the metal has entered the polishing room in better condition. At other times it has caused increased operations.

With the use of NUGLU, which is a liquid adhesive used cold, these operations have been cut down due to a faster cut and finer finish. This is best illustrated by the following example: Previous operations, polish on No. 180 and then on No. 220. The work, which is stainless steel, is then buffed. With the new adhesive, the work is polished on a No. 200 wheel and then buffed. Polishing time was decreased by 50% and buffing time was decreased by 20% due to the better finish produced by the No. 200 wheel.

Another example: Work previously polished with No. 180 and then finished with greaseless before plating. Now with NUGLU the work is polished on No. 180 only and then plated, eliminating 50% of the work. This naturally produces articles at a lower cost.

Another example: Polishing rejects cut from 9% to 2% due to the use of NUGLU. Same number of wheels used. The answer to all these is better fracture.

Break Up

In addition to the need of the proper fracture of each grain, each wheel must "break-up" properly. This is best illustrated by a look at your own wheels. You will notice that a wheel that produces a smooth finish has a head which is broken up into small clusters of grain. The smaller these clusters of grain, the smoother the finish. That is why a newly set-up wheel cuts rougher than a broken-in wheel and why a "cement" set-up wheel cuts rough at all times. In each case the clusters of grain are too big. Of course, the break-up is aided or hindered by the density of a wheel. The head of a soft wheel will break into smaller particles than the head of a hard wheel.

This is the reason why, until recently, only hide glue could be used for oil wheels. Most oil wheels are hard and only hide glue, which softens under heat, could be used. The soft head on this type of wheel does not cut, it burnishes. To over-come this difficulty, short steps in grain size had to be used and with the new adhesive, which cuts equally well with any size grain, larger steps can be used. Example: Cold rolled sheet steel No. 150 dry then No. 240 oil; or No. 120 dry and No. 200 oil.

NUGLU breaks up with an exceedingly small cluster size, thereby giving a smooth finish. In addition to this small break up which gives a smooth finish, NUGLU retains its grain characteristic. This means that a No. 180 wheel cuts as a No. 180 wheel should cut as long as there is any grain left on the wheel. It does not soften under heat. Therefore, a step as large as 80 to 100 numbers can be used. That is why cold rolled steel can be finished on No. 150 and No. 240 grain instead of No. 120, No. 150, No. 180 and No. 220.

Coarse Grain

This cluster size is important for coarse grain sizes as well as fine sizes. When a wheel does not break up properly, a rough cut is dug into the work making it harder for the succeeding operation to do its work. The theory of polishing and the only reason it is done is to prepare metal for a painted or plated finish. The finest size grain, consistent with economy, is used for the first operation. Each succeeding operation is done with a finer size until the work is ready for paint or plate. Why then, put in deep marks that only need extra work to remove?

Sometimes the polishing is done in one operation such as on automobile bodies. At other times many operations are necessary such as on cast iron sole plates for electric irons or farm implements. The one operation process on bodies (which are covered with paint) requires a smooth finish so that no marks will show on the modern car. In the multiple operation work, a coarse size must be used to remove sharp grinding wheel marks and then finer grains proceed through the polishing operations to a finish which can be plated and buffed to a beautiful lustre and smoothness. When the coarse grains dig in too deeply, the following operation must not only do its own work, but remove these

deep scratches also. The answer to this problem is to be sure your coarse grain wheels break up to the smallest possible clusters of grain thus insuring smoother work and faster production.

Cool Cutting

Heat of wheels and work play an important part on these coarse grains also. A cool free-cutting wheel is necessary if the maximum efficiency and best finish is to be obtained. NUGLU remains cool under the most severe heat conditions, and presents the grain to the work in such a manner that it fractures at the proper rate. It also breaks up into the small clusters that produce a smooth finish.

Another example of the possibilities of use of the proper fracture was recently shown in a body plant in Michigan. This company had previously used No. 36 grain for rough polishing and No. 60 for other work that required a better finish. With NUGLU as their adhesive, they use No. 46 for both jobs and wheels set-up with this adhesive and No. 46 cut faster than wheels set-up with hide glue and No. 36. It also cuts smoothly and uniformly so NUGLU replaces the No. 60 for the better finish work. One result of this change is that this body company cut the use of discs in half because they could use polishing wheels where they had previously used discs. They also cut down on the consumption of emery cloth due to the better finish obtained with wheels set-up with NUGLU. All this was accomplished by the proper fracture of grain, giving long life and free cut to their wheels.

Speed

An additional requirement of good polishing is the proper wheel speed. Speeds no higher than 7000 SFPM should be used to obtain the proper grain fracture. The maximum rate of cut with a proper fracture requires a speed of not less than 5000 SFPM. Practical tests have shown that speeds between 5500 and 6500 SFPM are ideal for efficient cutting and long life through proper grain fracture.

We give a concrete example of the advantages gained by one factory by the use of the correct adhesive, the correct grain, and the correct wheel. The work was cold rolled sheet steel formed to different radii. The polishing machine was an automatic and the wheels were made up of loose buffs. The wheels had to be extremely soft in order to follow the various radii, and the grain and adhesive had to be in exact harmony because the light gauge steel used would warp under heat. NUGLU allowed the grain to fracture just enough to keep an open free cutting wheel and permitted the head to break up into small cluster size so that the loose polishing wheel would follow the various radii producing a beautiful finish.

Manufacturers' Literature

Cements. Handbook on Smooth-On cements for the motor car and boat, home, factory and power plant, containing useful information for power plant engineers, mill, factory and shop superintendents, repair men, garage mechanics and householders. Smooth-On Manufacturing Co., 568-74 Communipaw Ave., Jersey City, N. J.

Centrifugal Galvanizer. A folder describing and illustrating the Tolhurst centrifugal galvanizer, which claims the following advantages: even coating, controls thickness and imparts smoother finish. Tolhurst Centrifugal Div., American Machine & Metals, Inc., 100 Sixth Ave., N. Y. City.

Chemicals. A catalog describing the emulsifying agents, synthetic resins, waxes and plasticizers, fatty acid esters of glycerine and glycols manufactured by the Glyco Products Co., Inc., 148 Lafayette St., N. Y. City.

Diamond Wheels for Grinding the Cemented Carbides. A folder on the new metal bonded diamond wheel. Its chief field is in thin wheels for cutting the cemented carbides and in cup wheels for resharpening cemented carbide tipped tools, especially those with sharp and narrow contacts that are destructive to resinoid bonds. Norton Co. Worcester, Mass.

Dial-Indicating Thermometer. Bulletin 4100, describes and illustrates the Wheelco dial-indicating thermometer, claiming the following features: simplicity of design; versatility of application; maximum accuracy; durable construction for long useful life. Wheelco Instruments Co., 1929 S. Halstead St., Chicago, Ill.

Directory of Association Members. January 1, 1939. Fifth Edition. A list of testing laboratories, their personnel and types of investigations made. Association of Consulting Chemists and Chemical Engineers, Inc., 50 E. 41st Street, New York City.

Electric Salt Bath Furnace. Catalog 106 describes and illustrates the Ajax-Hultgren electric salt bath furnace, an electrically heated furnace that is said to make it possible to utilize liquid heat treatments for many operations which formerly had to be done with less efficient methods. Ajax Electric Co., Frankford Ave. & Allen St., Philadelphia, Pa.

Iron-Nickel Alloys for Magnetic Purposes. Data sheet, Section IV No. 2, for insertion in the copy of the loose-leaf data book Nickel Alloy Steels, describes these permanent magnet alloys and also covers the high permeability alloys containing nickel. International Nickel Co., Inc., 67 Wall St., New York.

Modernizing Industry with the Electric Eye, is the title of a brochure giving data on PC-3 high speed photo electric counting equipment, which is reported to be a new development. Lipman Engineering Co., 415 Van Braam St., Pittsburgh, Pa.

Nickel in the Brass Foundry. An Index to bulletins. A series of bulletins based on this work and describing properties, applications and production of these metals and the nickel silvers is published by International Nickel Co., Inc., 67 Wall St., N. Y.

Oblique Tumbling Barrels. Catalog giving the automatic tilting arrangement for Baird tumbling barrels, covering constructional details of the machine proper and relating particularly to the new automatic tilting device. The Baird Machine Co., Bridgeport, Conn.

pH Papers. Bulletin devoted to a new and practical method for the practical plater to determine pH value in acid and alkaline solutions, it is reported, in a few seconds right at the tank. Paul Frank, 456 Fourth Ave., New York City.

Potentiometer Controller. Series 3200. This controller is adapted to actuate any customary type of fuel valve or electric contactor. Wheelco Instruments Co., 1929 S. Halstead St., Chicago, Ill.

Precise Control that Brings Results, is the title of a leaflet containing information on metallurgical control from ingot to final drawing of ribbon, wire and foil. Sigmund Cohn, 44 Gold St., New York City.

Process to Control Melting and Casting of Gold for Jewelry. A folder on Thermotrol which is said to have the following advantages: porosity minimized; added protection against pitting; gold is cast at its critical temperature; no "guess-work"; maximum density; simple to operate. Sigmund Cohn, 44 Gold St., New York City.

Silicates. Vol. 19, No. 3, P's & Q's, a folder containing "a message to those who use silicates of soda, or could use them", also showing relative moduli of elasticity. Philadelphia Quartz Co., 121 S Third St., Philadelphia, Pa.

Spray Equipment. A catalog discussing and illustrating the Eureka Models No. 10-10L-11; polychrome and shading brushes; art brushes; respirators; exhaust booths; material storage cabinets; oil and water separators; pressure-feed system; gravity-feed system, etc. Automatic Spray Co., 124-32 White St., New York City.

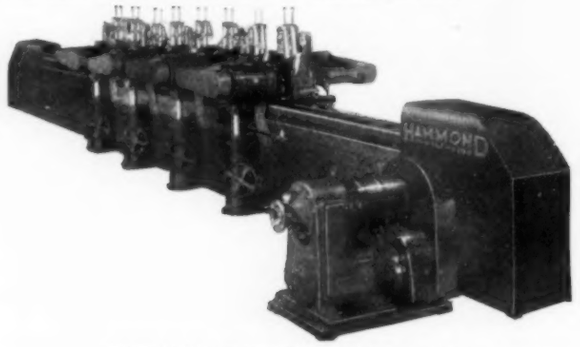
Storts Versus Distorts. A publication giving facts and good fellowship items about fusion weldmanship. Published by Storts Welding Co., 42 Stone St., Meriden, Conn., January-February. Contains technical information pertaining to various types of tanks for plating and pickling interspersed with philosophical and humorous matter. Copies of this and future issues will be sent free, by the Storts Welding Company, upon request.

Automatic Polishing and Buffing Machine with Automatic Composition Applicators

The Hammond Machinery Builders, Kalamazoo, Michigan, recently developed a model HBH-8 Strait Line Automatic Polishing Machine which is equipped with Automatic Composition Applicators called "Auto Dopers."

The machine shown has 8 ball bearing floating heads and each one will accommodate up to a 10 H.P., A. C. motor. Table has 88 cast iron 8 x 10¼" platens mounted on floor bearings and which run on steel track. Speed of the table can vary from 14.5' to 70' per minute by means of a variable speed reducing gear.

A very desirable feature of this machine is the "Auto Doper" which applies the composition automatically to the buffing wheels and which is adjustable so as to apply varying amounts and is built to handle rectangular bars from 2" square to 2"x6"x9" long. These "Auto Dopers" are operated by compressed air through a three-way valve timed to the conveyor of the buffing machine.



Straight-line automatic polishing machine.

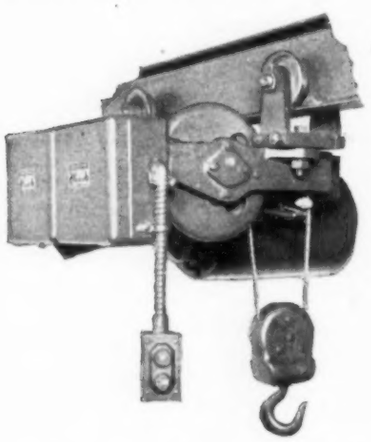
The "Auto Doper" is also made to accommodate 2" diameter bars which rotate after each application preventing a narrow buffing wheel from cutting grooves in the bar causing waste.

For further details, write Hammond Machinery Builders, Inc., 1601 Douglas Ave., Kalamazoo, Michigan.

Two-Speed AC Hoists

A new Electro Lift two-speed AC hoist has been built by Electro Lift, Inc., 30 Church St., New York City. This hoist has been designed to give slow speeds for starting, inching, running and stopping and fast speeds for rapid and efficient handling.

The hoist is reported to eliminate the hazards of quick or rough starting which is inherent in single speed machines and is particularly suitable for application where



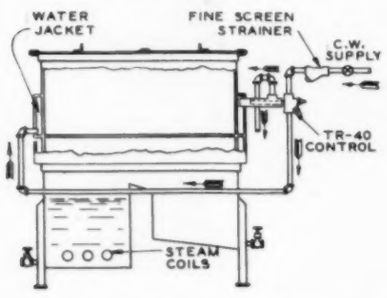
gradual starting and stopping is desired, such as serving machine tools, barrel plating, rubber molds, furnaces, handling concrete forms, clay products and for use in paper manufacture and foundries.

The hoist has squirrel cage motor with, it is said, low first cost and economical running cost. It is built in sizes of ¼ to 6 tons and has all of the speeds and ratings of standard Electro Lift hoists. It may also be equipped with traveling rope guide on the drum to eliminate the hazard of crossed or piled up cables where loads are pulled at an angle from the vertical. It is built in both single and twin hook types, the latter for handling long loads. The control may be either rope or push button type.

New Cooling Water Control

Sarco Company, Inc., manufacturers of steam specialties, 183 Madison Avenue, New York, announce the addition to their line of temperature regulators of the cooling water control, illustrated, and known as type TR-40.

This new regulator has been designed expressly for use on the cooling water jackets of internal combustion engines and compressors. It can be employed also in connection with water cooling of solvent recovery stills in dry cleaning plants and *on degreasers as used in metal manufacturing establishments.*



Use of water control on degreaser.

The control consists of a piston valve operated by a liquid expansion thermostat to throttle the flow of controlling water as required to maintain a constant temperature. The valve is provided with a bleeder port adjustable from the outside. This serves to allow a small amount of cooling water to flow at all times even when the valve is closed. This also keeps the thermostat active and ready to respond.

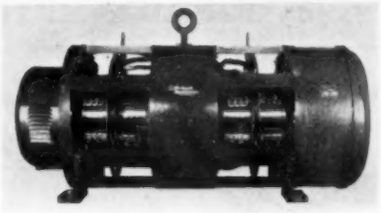
An important innovation is a safety device in the form of a fusible plug inserted between the thermostat plunger and the valve spindle in such a way that in the event of thermostat failure, the plug will collapse and the water valve will be forced wide open. This makes impossible damage to the engine in the event of thermostat failure.

Sizes ⅜" to 1" are now available and larger sizes also are contemplated.

Heavy Duty Production Plater

A new 3000 ampere motor generator has been recently built for the electroplating trade by the Hobart Bros. Co., Troy, Ohio.

The plater is manufactured in entirety at the Hobart plant. It is claimed that the high efficiency of the motor generator coupled with design allowances give ample capacity to handle peak loads easily as well as the light loads economically.



3000 *ampere motor-generator.*

The plating generator may be used for re-tinning, rust-proofing, chromium plating, electrotyping, electro-etching, electro-pickling and cleaning, and will plate most of the metals used in the industry.

Full details will be furnished by communicating with this company.

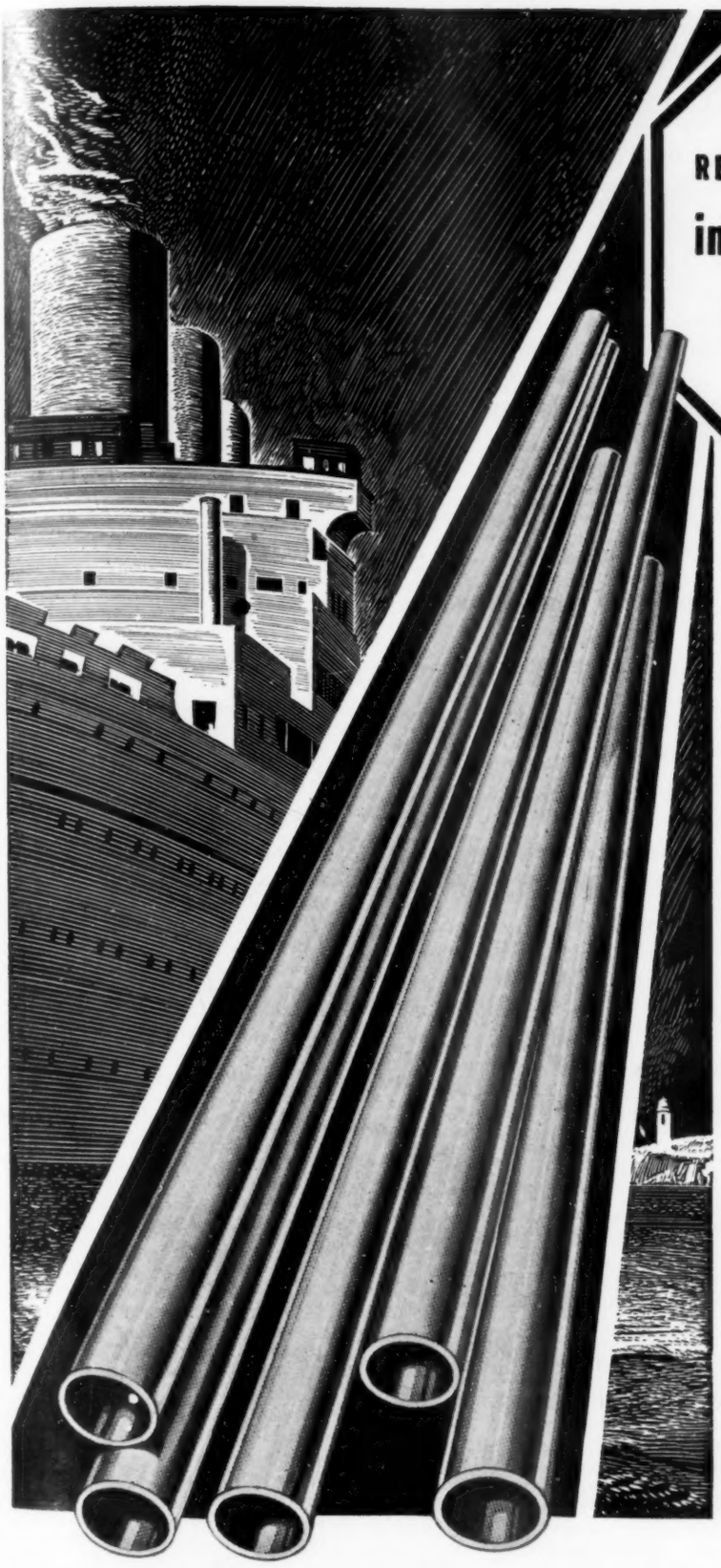
New Alkaline Cleaner

The Puritan Mfg. Co., Waterbury, Conn., has announced the development of a new alkaline cleaner called, Puridex. This cleaner is claimed to effectively remove carbon smut and similar solid dirt from work when the work is made the anode. Due to the high conductivity of the cleaner, relatively high current densities are obtained, using conventional voltages.

New Floor Material

The Flexrock Co., 23rd & Manning Sts., Philadelphia, Pa., have recently announced that their "Ruggedwear Resurfacer has undergone its second major improvement."

The first improvement was the cellulose process which, it is claimed, imparted tough-



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RELIABILITY AND LONG LIFE

in Condenser Tubes use

COPPER-NICKEL ALLOYS

Since the early days of steam power at sea, the rapid corrosion of condenser tubes subjected to salt water has been a serious problem.

However, Copper-nickel alloys have come to the rescue. Due to their exceptional resistance to corrosion at high pressures and temperatures, these alloys have lengthened the life of condenser tubes, reduced overhaul costs and actually paid their own way. As a result the U. S. Navy and the world's leading commercial fleets as well as the navies of other nations now make it standard engineering practice to specify Copper-nickel alloys for condenser tubes.

With Copper-nickel alloy tubes available the ship owner need no longer take into account the possibility of frequently recurring expenditures on tube renewals, while the marine engineer can go to sea with the assurance of absolute reliability in his condensing plant.

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67 WALL STREET - - - NEW YORK, N. Y.

THEY PICKED THESE CLEANING JOBS as Tough Ones!

Cleaning Prior to—
- brass plating or rubber coating
- browning process
- chrome plating
- vitreous enamelling

Clean—
- black smut from steel
- sulfurized oil from metals
- tar from sheet metal

Remove—
- buffing compound from:—
  - polished cast aluminum
  - recesses in die castings
- drawing compound from stampings
- lapping compound from metals
- tripoli from nickel silver

Stripping—
- paint and enamel from old equipment

We recently asked a large number of metal product and finishing plants to tell us what they considered were their hardest metal cleaning problems.

Here are the cleaning jobs that were most commonly picked as tough ones.

But They're Not Hard For MAGNUS CLEANERS

Every one of these cleaning jobs is being successfully and economically handled by one or more Magnus Cleaners.

There's a good reason for this. Magnus Materials are the result of a scientific approach to the problems of metal cleaning, which finds the correct answers, perfects a material to satisfy specific requirements and tests it out thoroughly in the field before offering it to you.

Every Magnus Service Man has the whole story on these tests and the definite results obtainable from Magnus Cleaners. His information is yours. Make use of it!

CALL IN YOUR MAGNUS MAN

He can help you solve your metal cleaning problems and cut costs.

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Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants.

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MAGNUS CLEANERS

ness to the floor material as well as simplifying the process of application.

The recent addition of Montmorillonite is said to increase the coverage capacity of the floor patching material, thereby lowering the cost per sq. ft. of patching and resurfacing concrete floors.

Montmorillonite is a chemical composed of manganese, silica, alumina and iron. The addition of Montmorillonite is said to make the resurfacer mix easier with cement, sand and stone, thereby decreasing labor costs.

Applying resurfacer

Pressure Fan

The B. F. Sturtevant Co., Hyde Park, Mass., have announced the development of a pressure fan which is claimed to have the ability to operate against wind resistance or the resistance of filters, baffles, discharge conduits, etc. The blades are so pitched that regardless of wind direction or velocity or fan location, there is no appreciable effect on air delivery.

Principal use of the pressure fan is the moving of large volumes of air against resistance or where space requirements call for

a rugged yet highly compact unit. The ease with which it may be installed, and the comparatively low initial and operating cost makes it well adapted for almost any industrial application, including heating, ventilating, cooling, mechanical draft, drying, humidifying and fume, or dust removal.

Letters From Our Readers

March 7, 1939

Dear Dr. Meyer:

I wish to pass a complimentary word upon the excellent resume of the technical developments in electro-plating and finishing during 1938, appearing in the *Metal Industry*, and written by you.

However in doing so, I cannot help but call your attention to two formerly solved problems.

The troublesome problem of plating upon stainless steel was solved back in 1925, and I refer you to the November issue of the *Metal Industry*. I call particularly to your attention the thoroughness and broadness with which this article reported the experiments performed, and the specificness of the methods and conditions of successful deposition, noting particularly the last paragraph.

At the time this work was done, stainless steel was plated in all the acid baths, zinc, copper and nickel with adherent deposits, while with the same treatments in cyanide solutions, silver, copper, zinc, brass they failed.

Who in 1925 could foresee that anyone would purposely desire to plate copper upon stainless steel, which at that time was considered and for which it was claimed the metal par excellence?

The other solved problem pertains to the adherence of nickel upon tin plate. The solution of this problem was presented in a paper before the New York Branch of the American Electro-Platers' Society and published in the Review back in 1915. Unfortunately I cannot refer you to the issue, but it consisted in treating tin plate cath-

odically in a sodium cyanide bath for three to five minutes. The nickel plated tin plate could then be twisted, bent at right angles over itself and fabricated without the nickel peeling.

With sincerest regards, I remain

Very truly yours,
Joseph Haas

So. Norwalk, Conn.

Metal Industry,
New York.
Gentlemen:

In the Platers' Guidebook, 1938 edition, you give the formula for blue on brass: hyposulphate soda, 8 ozs; lead acetate, 4 ozs; water, 1 gallon. In the March 1937 issue of *Metal Industry*, you give the formula for blue on brass: sodium thiosulphate, 50 grams; lead acetate, 25 grams; water, 1 liter. Does this mean that you can use sodium hyposulphite ($Na_2S_2O_4.2H_2O$) or sodium thiosulphate ($Na_2S_2O_3.5H_2O$) and get equal results?

I would like to make a suggestion in regard to the names of chemicals used in the plating industry. I think that the plating industry and its followers have advanced to a stage where we can use true chemical names for such fancy ones like "gold sulphuret of antimony", "blue vitriol", and others.

On December 16, 1938, we wrote you asking for a copy of the May issue of *Metal Industry*. You wrote that you had mailed us one but evidently it must have been lost in the mail as we never received it. Now I am wondering whether or not it would be possible for me to buy a copy of this issue. It is the only copy that is missing from my file and since this file of magazines has been so useful to me, it would mean a great deal to me if it would be possible to fill in the gap left by this one missing issue.

Trusting that we may have an early answer to the above questions, we remain

Yours truly,
Grand Rapids Brass Company
A. Preston, chemist

Grand Rapids, Mich.

Dear Mr. Preston:

The two formulae mentioned in your letter are practically synonymous and the hyposulphite of soda refers to sodium thiosulphate ($Na_2S_2O_3.5H_2O$) and not to $Na_2S_2O_4.2H_2O$.

I agree with you that it is time for the plating industry to adopt the true chemical names and the above-mentioned illustration is one of the many cases in which confusion could arise due to the failure not to use chemical nomenclature. The editorial policy of *Metal Industry* is to now use the chemical nomenclature and this system has also been followed in the complete revision of the 1939 Platers' Guidebook.—Ed.

February 1939

Gentlemen:

Will you please place my name on your mailing list for a copy of Platers' Guidebook 1939 edition.

I would like to compliment you on the get-up of the *Metal Industry*. It is certainly just what the plater and plating executive require for guidance and I always look forward with interest to each issue.

Murdoch & Co., Ltd.,

Kilsyth, Scotland.

ATTENTION

GOLD PLATERS

EVERYBODY'S DOING IT.

WHY DON'T **YOU** TRY THE CLEAN, ECONOMICAL MODERN WAY.

Buy your gold plating solution scientifically prepared (add only water) with gold content certified and uniform results assured by one of the oldest firms in the industry.

You'll never again be without it.

For help in plating problems, write our information department, in charge of Dr. C. B. F. Young, nationally known electro-chemical engineer.

A. ROBINSON & SON

"Sixty years at Precious Metals"

131 CANAL ST. NEW YORK

Assayers and Refiners of Precious Metals—Gold recovered from discarded solutions — Fine Silver Anodes.

January 17, 1939.

Metal Industry,
New York.
Gentlemen:

I quite enjoyed that very interesting article which you had in the December number of your publication entitled, "The Goldsmiths' Guild of London". My associates and I, out here on the Western Coast thought it most interesting.

The people out here do not seem to know much about the historical aspects of the gold and silver craftsmanship.

We would enjoy an occasional article of this kind if you could spare the space in your valuable publication.

Yours truly,
Stephen P. Hale

San Francisco, Calif.

Dear Mr. Hale:

We are glad that you enjoyed Mr. Little's article, and I am pleased to say that another article will be prepared by Mr. Little within the next few months, on a similar subject.

Mr. Little is an avid student of the history of metal working and is as interesting to talk to as his articles are to read.—Ed.

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Recognized as the world's largest manufacturer of chromium chemicals, Mutual brings to the plating industry a basic source of chromic acid.

Our facilities cover every step in its production, from the mining of the chrome ore on a remote island in the Pacific to the wide distribution of the finished product through warehouse stocks in the principal consuming centers.

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New Books

Transactions of the Electrochemical Society, Volume LXXIV. 1938. Published by the Electrochemical Society, Inc., Columbia University, New York City. Size 9¼" x 6¼"; 649 pages. Price $6.50 to non-members.

The papers of this volume were presented at the 74th general meeting, held in Rochester, N. Y., October 12-15, 1938.

The volume contains the papers of the session on "Plastics in the Electrochemical Industry"; the session on "Electrodeposition"; the session on the "Metallurgy of Silver", and the session on "Corrosion and pH."

This volume is particularly valuable to the students of electrochemistry because of the many excellent papers on silver plating, some of which are: "Brighteners in Silver Plating Solutions. A Preliminary Study," by B. Egeberg and N. E. Promisel; "The Electrodeposition of Silver Alloys from Aqueous Solutions," by F. C. Mathers and A. D. Johnson; "Corrosion of Silver Anodes in Potassium Silver Cyanide Plating Solution", by A. E. Thurber, D. Gray and R. H. Sholtz; "The Adherence of Thick Silver Plate on Steel", by F. C. Mathers and L. I. Gilbertson; "The Electrodeposition of Silver from Solutions of Silver Nitrate in the Presence of Addition Agents", by R. Taft and L. H. Horsley; "Silver Plating from Acid Complex Iodide Baths", by D. K. Alpern and S. Toporek; "Cold Welding of Silver", by A. Butts and G. R. Van Duzee.

Index to A.S.T.M. Standards and Tentative Standards. Published by the American Society for Testing Materials, Philadelphia, Pa. Size 9" x 6"; 129 pages; paper bound. Copies are furnished without charge on written request to A.S.T.M., 260 S. Broad St., Philadelphia.

The latest edition of the Index gives information on all of the 870 standards as of January 1, 1939, and is of service to anyone wishing to ascertain whether the Society has issued standard specifications, test methods or definitions covering a particular engineering material or subject and it is of help in locating the standards in the volumes where they appear.

All items are listed in the Index under appropriate key-words according to the particular subjects they cover. As a convenience a list is given of the specifications and tests in numeric sequence of their serial designations.

Plating and Finishing Guidebook. Published by Metal Industry Publishing Co., 116 John St., New York. Size 5¼" x 8"; 85 pages. Eighth edition, 1939. Sent free of charge to subscribers of Metal Industry.

The eighth edition of this valuable guidebook on plating and finishing has undergone complete revision under the editorship of Dr. Walter R. Meyer.

A staff of well-known consultants has assisted in the preparation of the various chapters in the book. In all cases the subject matter has been brought up-to-date, and in most cases, has been enlarged upon. The subject matter includes almost all phases of plating and finishing, including plating solutions; methods of analysis; coloring of metals; methods of determining thickness of coatings; lacquering; polishing; cleaning; plating tanks, and generators.

The contributing authors to the volume are:

E. A. Anderson
Abner Brenner
Dr. George Dubpernell
Dr. A. Kenneth Graham.
Nathanial Hall
George B. Hogaboom, Jr.
Richard O. Hull
Dr. H. G. Mitchell
Floyd Oplinger
Nathan Promisel
Dr. Karl Schumpelt
H. J. Wills

This volume has followed the very high standards of accuracy and practicability which were set by the previous editors of the Guidebook, namely: Oliver J. Sizelove, T. H. Chamberlain and George B. Hogaboom, Jr.

The Chemical Formulary. 1939 Edition. Volume IV. Editor-in-Chief, H. Bennett. Published by the Chemical Publishing Co., New York. Size 9" x 6"; 638 pages. Price $6.00.

The 1939 issue of Chemical Formulary has been completely re-written and contains over six-hundred pages of practical formulae. The literature on the various subjects discussed has been drawn from freely including both the patent literature and the periodical literature.

As would be expected, in attempting such a comprehensive task, some of the formulae presented may be impractical or given with insufficient details to be of practical use. Some of the subjects discussed are adhesives, cosmetics, lubricants, plating, polishes and abrasives, soap, textiles. In addition, the book contains a table of trade name chemicals as well as suppliers of these materials and a list of chemicals with suppliers.

The section on plating contains various formulae for plating solutions and for coloring of metals. Unfortunately, the various solutions mentioned are poorly arranged ac-

to subject matter, and a wider use of cross-headings would have made the solutions more readily found. Some of the plating solutions are not according to regular practice but were evidently derived from the patent literature and one solution for nickel plating on zinc makes no mention of nickel salts whatsoever.

The vast amount of information contained in this volume makes it valuable not only to the technical man but to the general public.

Machinery's Handbook (Tenth edition). Size 4½" x 7"; 1815 pages. Published by the Industrial Press, 148 Lafayette St., New York. Price $6.00.

The tenth edition contains 585 pages of important new matter not found in editions earlier than the sixth, 447 pages not found in the eighth, and 250 pages not found in the ninth edition. This new material consists mainly of very important new or revised engineering or manufacturing standards, machine shop data, and a vast amount of general information required by the designers and builders of all types of machines or other mechanical products.

These new features include, by way of illustration, standard mounting dimensions, with horsepower and speed ratings for different types of motors; the British standard limits and fits for holes and shafts; the American standard for different gages; selection of tool steels for different classes of tools; additional data on various screw thread standards; tables for checking gear sizes by the pin and chordal methods of measurement; standard grinding wheel shapes and dimensions; standard forming tool blanks; standard tolerances for forging; American standards for drawings and standard abbreviations and symbols; selection of lubricants for bearings; standard V-belt drives; steels for gearing; brass, bronze, and non-metallic gearing; recent set-screw standards; new hardness conversion tables; checking screw thread sizes and numerous other new subjects.

The general character of the tenth edition is similar to that of preceding issues, and it includes, of course, many standard features found in earlier editions, such as mathematical and other tables not subject to change. The complete book is divided into 134 main divisions, featuring subjects of especial importance to everyone responsible for the design or construction of anything mechanical.

Proceedings of the Third Annual Forum Porcelain Enamel Institute. Published by the University of Illinois, Urbana, Ill. Size 9" x 6"; 228 pages. Price $2.00.

A well printed volume of the Proceedings of the Porcelain Enamel Institute meeting held October 12-14, 1938.

The subjects discussed cover almost all phases of porcelain enameling, and the review of the American literature on porcelain enamel is particularly valuable.

Some of the papers included in this volume are: Tentative Tests for Abrasion Resistance; Factors Affecting Sag Resistance Properties of Enameling Iron; Methods of Testing Enameling Stock; British Enameling Practice; Discussion of One Cover Coat Ware; Ball Milling Practice; Sources of Enamel Shop Waste; Black Specking of Hollow Ware; Control Methods for Gray Enamel Manufacture; Problems in Milling and Application of Dry Process Enamels; Automatic Blasting; Some Observations on Dry Process Enameling; Color Matching of White Parts; Circulating Ground Coat Systems; Burning Tools for Enameling; Automatic Spraying and Brushing Equipment; Flash and Roll Seam Welded Assembly for Enameling; Relation of Some Sheet Welding Practices to Certain Porcelain Enamel Defects; Comparisons of English and American Enameling Plants.

The Journal of the Institute of Metals. Volume LXIII. Edited by S. C. Guillan. Published by the Institute of Metals, London, S.W.1 England. Size 8½" x 5½"; 311.

The papers of the 1938 autumn meeting of the Institute of Metals are included in this volume. Some particularly interesting papers on metal surfaces are: "Oxidation-Resistance in Copper Alloys", by L. E. Price and G. J. Thomas; "The Tarnishing of Silver and Silver Alloys and Its Prevention", by L. E. Price and G. J. Thomas.

The other papers are of the usual high standards of the Institute on various subjects of physical metallurgy.

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Associations and Societies

American Electro-Platers' Society

Annual National Convention

The Educational Program for the 1939 Convention of the American Electro-Platers' Society to be held at Asbury Park, N. J., June 19 to 22 inclusive, has been announced as follows by Chairman *George B. Hogaboom.*

First Session: Monday afternoon June 19. *Charles H. Proctor*, presiding: Founder, American Electro-Platers' Society.

1. "Notes on Adhesion of Electroplated Coatings". *A. W. Hothersall, M.Sc.*—Woolwich, London, England.

2. "Distribution of Deposits on Cup-Shaped Cathodes". *G. F. Gardam, B.Sc.-A.R.C. Sc.*

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BRIGHT ZINC
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now obtainable using the

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Eliminates all dull spots in the bright zinc or bright cadmium deposit.

Let us solve your cleaning problems. Write for full particulars on Cathanodic Cleaning Process and Clepo Cleaning Compounds.

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Chicago, Ill.

3. "Recent Developments in British Plating Practice". *C. F. Francis-Carter, Ch. E.*

4. "Chemical Methods for Testing Thickness of Metallic Coating". *S. G. Clark, Ph.D.*

The above papers are contributions from the Electro-Depositors' Technical Society, London, England.

5. "Review of Electroplating Methods in France". *M. Ballay, Ph.D.* Consulting Engineer, Paris, France.

Second Session: Tuesday morning June 20. *John Acheson*, presiding: President, Toronto Branch.

1. "The Role of Diffusion in Electroplating Process." *Dr. J. T. Burt-Gerraus*, Toronto University, Toronto, Can.

2. "Theoretical Training for the Electroplating Industry." *Dr. J. U. MacEwan Birks*, Professor of Metallurgy, McGill University, Montreal, Can.

3. "Electrodeposition of Black Molybdenum Finishes". *R. O. Hull*, Cleveland Branch, Grasselli Chemical Co., Cleveland, Ohio.

4. "The Ampere Hour Meter". *Burton G. Daw*, St. Louis Branch, president, LaSalco, Inc., St. Louis, Mo.

Third Session: Tuesday afternoon, June 20. 1:30 PM. *Charles C. Conley*, presiding: President, Dayton Branch.

1. "Chromium Plating Dies and Gauges." *Dr. D. A. Cotton*, Anderson Branch, Director Research Delco-Remy Div., General Motors Corp., Anderson, Ind.

2. "Anodic Coating of Aluminum". *Dr. Junius D. Edwards*, Assistant Director of Research, Aluminum Co. of America, New Kensington, Pa.

3. "The Application of X-Ray Diffraction to Electroplating Problems". *Herbert R. Isenberger*, St. John X-Ray Service, Inc., Long Island City, N. Y.

4. "The Filtration of Electroplating Solutions." *Dr. Walter R. Meyer*, Bridgeport Branch, Editor *Metal Industry*, New York.

Fourth Session: Tuesday evening, June 20. 7:30 PM., *Joseph Underwood*, presiding: President, Philadelphia Branch.

1. "A Study of Electrolyte Films." *Dr. A. Kenneth Graham*, Philadelphia Branch, Consulting Engineer, A. Kenneth Graham and Associates, Jenkintown, Pa., and *Harold J. Read*, Instructor in Electrochemistry, University of Pennsylvania, Philadelphia.

2. "The Story of Steel for Electroplating." *Frederick Fulforth*, Philadelphia Branch, The Proctor Electric Co., Philadelphia, Pa.

3. "The Modern Generator and Rectifier." *Guerin Todd*, Chief Engineer, Hanson-Van Winkle-Munning Co., Matawan, N. J.

4. "Time Pieces—From Sun Dial to Wrist Watches". *L. A. Critchfield*, Philadelphia Branch, Hamilton Watch Co., Lancaster, Pa. This will be of interest to the ladies. The Hamilton Watch Co. is lending their collection of time pieces for this paper.

Fifth Session: Wednesday evening, June 21. 7:30 PM. *James W. Hanlon*, presiding: President, Chicago Branch.

1. "Addition Agents in Electroplating Processes." *Dr. Frank C. Mathers*, Professor of Electrochemistry, University of Indiana, Bloomington, Ind.

2. "A Review of Finishing Methods." *Dr. Gustav Klinkenstein*, Newark Branch, Vice-President and Technical Director, Maas & Waldstein Co., Newark, N. J.

3. "Agitation." *Donald Wood*, Boston Branch, Reed & Barton, Taunton, Mass.

4. "Adhesion of Electrodeposits." *Frank C. Mesle*, Oneida, Ltd., Oneida, N. Y.

Sixth Session: Thursday morning, June 22. 9:30 AM. *Ralph J. Liguori* presiding: President, New York Branch.

1. "The Effect of Certain Wetting Agents upon Nickel Deposits." *Dr. C. B. F. Young*, New York Branch.

2. "Practical Suggestions for Efficient Plating Room Layout." *D. P. Hartshorn, Jr.*, Springfield Branch, Chemist, Westinghouse Electric & Mfg. Co., Springfield, Mass.

3. "Summary of Researches on Electrodeposition at the National Bureau of Standards." *Dr. William Blum*, Baltimore-Washington Branch.

4. "Porosity Tests for Nickel Coatings on Steel." *P. W. C. Strausser*, Research Associate A.E.S. at Bureau of Standards.

5. "Dropping Tests for Zinc and Cadmium Coatings on Steel." *A. Brenner*, Chemist, Bureau of Standards.

6. "Further Study of Measurements of pH in Alkaline Plating Solutions." *M. R. Thompson*, Chemist, Bureau of Standards.

7. "A Study of Silver Plating for Industrial Applications." *C. S. Love* and *A. C. Simon*, Metallurgical Div., Bureau of Standards.

Regional Meeting of the New England Branches

Hotel Garde, Hartford, Conn.

Saturday, April 15, 1939.

Speakers:

A. B. Wilson, Past Supreme President, A.E.S., Chevrolet Motor Co., Detroit, Mich. Subject—"Research."

Ed. Charleson, Yale & Towne Mfg. Co., Stamford, Conn. Subject—"Finishing Die Castings."

Arthur W. Tracey, American Brass Co., Waterbury, Conn. Subject—"Corrosion of Plated Products."

T. H. Chamberlain, Chase Brass & Copper Co., Waterbury, Conn. Subject—"The Importance of Chemistry to the Plater."

Educational session 2:30; Banquet 7:00; Tickets $2.50. Entertainment and dancing. *Ellsworth T. Candee*, treasurer; Metal Hose Div., American Brass Co., Waterbury, Conn. Ladies will be entertained in the afternoon.

Anderson Branch

The Anderson Branch of the A.E.S. held their monthly dinner meeting Tuesday, March 7, at 6:30 PM at the Y.M.C.A., president *L. R. Hinsch*, presiding.

W. M. Phillips, National President of the A.E.S., was the speaker. He presented the life story of the 1939 automobile die cast radiator grille, and supplemented his talk with technicolor lantern slides and motion pictures. The motion pictures showed the development of the grille, starting from the design and carrying through the various manufacturing processes including die casting, trimming, polishing and plating.

E. L. McKinney is secretary-treasurer.

Boston Branch

The Boston Branch held a successful educational session and dance, Saturday afternoon and evening, March 4.

The speakers at the technical session were *Floyd Oplinger*, Electroplating Div., E. I. duPont de Nemours & Co., Niagara Falls, N. Y., who spoke on "High Speed Copper Plating."

Dr. Gustav Klinkenstein, vice-president, Maas & Waldstein Co., Newark, spoke on "Novelty Wrinkle Finishes", and *George B. Hogaboom* whose subject was "Coloring of Metals".

Over 100 persons attended the educational session and almost 300 were present at the banquet and dance in the evening, which was featured by a prominent girls' orchestra. *W. C. Treadwell* was chairman.

Bridgeport Branch

The March 17th meeting was addressed by *H. LeRoy Beaver*, who spoke on "Barrel Finishing of Metals."

About 75 members and guests were present.

The April 21st meeting of the Branch will have *Ed H. Bucy*, technical director of Zapon Div., Atlas Powder Co., as the speaker, and his subject will be, "Formulation and Pigmentation of the Latest Types of Organic Finishes."

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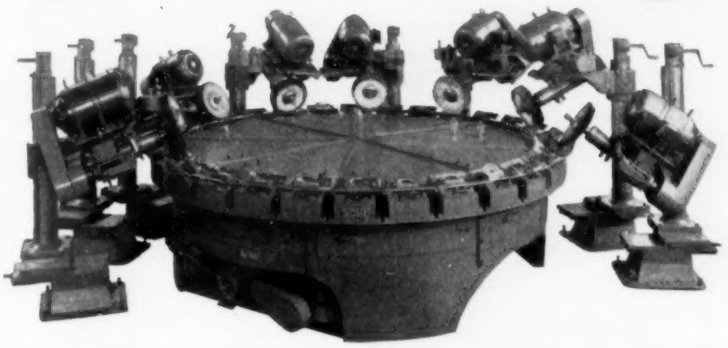

In key plants where automotive hardware such as door handles, trunk hinges, regulator handles, brackets and many other similar parts are measured in hundreds of thousands and more, ACME ROTARY AUTOMATICS, like the one above, rate as "standard practice" machines for high production finishing.

And in many feeder factories where the ability to continuously satisfy these manufacturers rests on superior automatic finishing performance, there too, you will find many and varied Acme Automatics preferred . . . each one regardless of size and application offering comparable advantages in *controlled production, uniform finish* and other *vital savings.*

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Detroit Branch

Burton G. Daw, president LaSalco, Inc., St. Louis, Mo., will address the Branch April 7 and give a practical demonstration in a talk entitled, "What Happens in a Plating Barrel."

W. M. Phillips, president of the A.E.S., of General Motors Corporation, Detroit, Mich., will be the speaker on May 5.

Milwaukee Branch

The Milwaukee Branch of the A.E.S. extends a cordial invitation to attend the annual Educational Meeting and Banquet on Saturday, April 29, at the Hotel Schroeder, W. Wisconsin Av., at N. 5th St., Milwaukee, Wisc.

An excellent educational program has been prepared, and will be held in the Green Room commencing at 2 P.M. conducted by *Henry Bornitzke*. Membership is not necessary to attend either function.

EDUCATIONAL PROGRAM

"A Discussion of Some Fundamentals of Electroplating Practice." *W. L. Pinner*, courtesy of Houdaille-Hershey Corp.

"What Do We Know", *George B. Hogaboom*, courtesy of Hanson-Van Winkle-Munning Co.

"Making Wrinkle Finishes More Attractive", *Dr. Gustav Klinkenstein*, vice-president and technical director, Maas & Waldstein Co.

The banquet and entertainment will be held in the Crystal Ball Room at 7 PM in charge of *Jack Geismann*. Heinie and His Grenadiers, the outstanding feature of the last Milwaukee Convention will entertain, also excellent floor show. The ticket for the banquet will be $3.00 per person.

Robert Steuernagel is secretary-treasurer.

Newark Branch

At the April 7 meeting, *Paul Oldam*, E. Poeter and Co., Irvington, N. J., will give a

EGYPTIAN HIGH-BAKE N. F. R.

To manufacturers making hundreds of various items which require a finish, we suggest that they look into EGYPTIAN HIGH BAKE N.F.R., the NEW type of Synthetic . . . A multi-coat finish which bakes in one operation . . . A finish highly resistant to chemicals . . . A finish which, when used as a complete system, contains rust inhibitive properties and many other features of interest to manufacturers now using one or another of the many types of available finishing materials.

EGYPTIAN HIGH BAKE N.F.R. comes in a large variety of colors as well as Black, White, and Clear . . . Colors are furnished in high gloss . . . Clear may be had in high or medium gloss . . . Excellent flexibility and adhesion.

Write for further information and recommendations regarding the use of EGYPTIAN HIGH BAKE N.F.R. for your own particular requirements.

EGYPTIAN FINISHES

THE EGYPTIAN LACQUER MFG. COMPANY
ROCKEFELLER CENTER, NEW YORK

talk on Gold Plating, the subject of his talk being, "The Cyanide Radical in Gold Plating Solutions."

Dr. Edward B. Sanigar of Temple University, Philadelphia, Pa., will be the speaker on April 21. On May 5, the Branch will be addressed by *Louis Donroe*, Pyrene Mfg. Co., Newark, N. J.

New Haven Branch

Willoughby G. Sheane will address the April 6th meeting of the Branch on "Organic Finishing." Mr. Sheane is in charge of organic finishing at the Bridgeport Works of the General Electric Company.

Joseph Sullivan is secretary.

New York Branch

The March 10 meeting was featured by an illustrated lecture by *Wm. J. Schneider*, whose subject was, "Present Day Developments in Copper Plating."

The second monthly meeting, on March 24, was a business meeting followed by a Question Box presided over by *Dr. C. B. F. Young*.

F. J. MacStoker is secretary.

Philadelphia Branch

The members at the March 24 open meeting were given a talk on "Filtration of Electroplating Solutions" by *Dr. W. R. Meyer*, Editor, *Metal Industry*, and by *Walter Helbig*, engineer Darco Corporation on the "Use of Activated Carbon in Purifying Plating Solutions".

E. J. Zurbach, Jr., was technical chairman.

The meeting was a joint meeting of the American Electro-Platers' Society and the Electrochemical Society.

Electrochemical Society

The Spring meeting of the Electrochemical Society will be held at Columbus, Ohio, April 26-29 inclusive at the Hotel Deshler-Wallick. There will be three scientific-technical sessions.

The opening session on Thursday morning will be devoted to Ceramics, with *L. I. Trostel* of Baltimore, presiding.

The Thursday luncheon will be in charge of the Theoretical Electrochemistry Division, at which Professor *George Glockler* will discuss "Theoretical Electrochemistry of Gases."

A general meeting, open to the public, will be held on Thursday evening at which time *John H. Thomas* will address the gathering on "The Production of Fiberglass and Glass Diaphragms."

Friday morning, a session will be devoted to "Electrodeposition and Cells," with Professor *E. M. Baker*, presiding.

Papers will be presented by the following authors: *W. A. Wesley* and *J. W. Carey*, *Charles L. Faust* and *Beaumont Thomas*, *William J. Travers*, *George A. Moore*, *Kenneth C. Newnam* and *F. C. Mathers*, *M. deKay Thompson* and *J. Baborovsky*.

The Saturday morning session will be devoted to "Organic Electro-Products" with Professor *Sherlock Swann* in the chair.

The Saturday afternoon session will be on "Corrosion of Alloys."

American Zinc Institute

The 21st Annual Meeting of the American Zinc Institute will be held at the Hotel Statler, St. Louis, Mo., on Monday and Tuesday, April 17 and 18.

On Monday the Institute will report on its activities during the past year. The Institute's promotion work will be specially featured. Washington news, the zinc market and the zinc situation abroad are among the topics which will be covered.

On Tuesday several speakers will be heard on the subject of the market for zinc coated products. The program will also include a number of technical topics of vital interest. The Steel Corporation's technicolor movie "Men Make Steel" will close the afternoon session.

Entertainment features will include the annual dinner which will be held on Monday evening.

Further additions to the program are pending and will be announced later.

Ernest V. Gent is secretary.

Obituaries

Corliss E. Sullivan

Corliss E. Sullivan, Cleveland, Ohio, director of Republic Steel Corp., B. F. Goodrich Co., Pioneer Steamship Co., Standard Products Co., and the Cleveland Graphite Bronze Co., among other activities, died February 14 at the age of 62.

Joseph Congdon Belden

Joseph Congdon Belden, president and chairman of the board, Belden Mfg. Co., Chicago, makers of electric wire and cables, passed away recently in Chicago, after an illness of several months. Mr. Belden was formerly president of the Employers' Association of Chicago and a former first vice-president and director of

the Illinois Manufacturers' Association. After graduating with a degree in philosophy from the Sheffield Scientific School of Yale in 1897, Mr. Belden founded his own company in 1902.

James Shand

James Shand, inventor and pioneer in the automobile field, formerly vice-president and general manager of the Joseph N. Smith Company, manufacturer of auto parts, died February 8 in Detroit. Mr. Shand was 78 years old.

Frank E. Hodek

Frank E. Hodek, president, General Porcelain Enameling & Mfg. Co., Chicago, died recently in St. Petersburg, Fla., aged 71 years. Mr. Hodek also was president of the Century Vitreous Enameling Co., Clearing, Ill.; Neon Displays, Inc., Milwaukee, and Steffenguide Corp., Chicago. He was born in Bohemia and went to Chicago with his parents in 1871 at the age of three. His first business affiliation was in the dry goods field and after a successful career in this and the general merchandising business in Chicago, he became associated with the enameling industry in 1915. In 1917 he was elected president of the General Porcelain Enameling & Mfg. Co. His son, Frank E. Hodek, Jr., has been president of the Porcelain Enamel Institute for the past two years.

Harrison J. L. Frank

Harrison J. L. Frank, Detroit, Mich, president American Society of Engineering and president of the Bulldog Electric Products Company, Detroit, Mich., died February 14 in a Miami Beach hospital following a short illness. Mr. Frank was 59 years of age.

E. J. Bauer

E. J. Bauer, for twenty years with the Medard Company, St. Louis, Mo., died on January 8, aged 70 years.

Personals

George F. Wales, for the past 15 years chief engineer of the American Radiator Company's stamping plant at Buffalo, N. Y., has resigned. Mr. Wales will head the management of the Strippit Corp., Buffalo, of which he is president and founder.

W. E. Gardner has recently been appointed manager of the Boston branch, 135 Binney St., Cambridge, Mass., of the Crucible Steel Company of America, 405 Lexington Ave., New York City. Mr. Gardner succeeds *W. P. Knecht*, who has been appointed manager of the London, England, office, 9-21 Shand St., Tooley St. S. E. 1.

C. W. Franz, graduate of Phillips Exeter Academy and Sheffield School of Yale, has been added to the sales staff of Acheson Colloids Corp., 2150 Washington Ave., Port Huron, Mich., succeeding *T. P. Hunt*. Mr. Franz will do sales development work in Illinois territory from his headquarters at 330 N. Michigan Ave., Chicago, Ill.

Harlan M. Gale is now associated with Maas & Waldstein Company, 438 Riverside Ave., Newark, N. J., as a sales representative for the New England territory. Mr. Gale, who was formerly connected with the Cleveland Varnish Co. and the Glidden Co. is well known in New England, and has had wide experience in selling, servicing, and demonstrating finishing materials of all kinds.

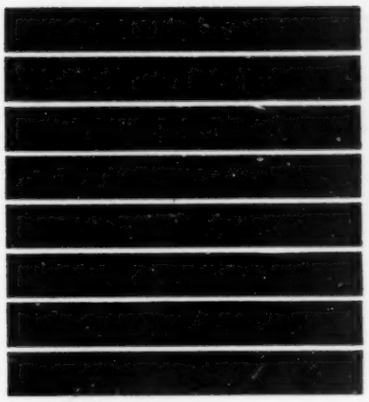
Dr. Paul L. Smith, National Bureau of Standards, Washington, D. C., has been reappointed for 1939 as research associate of the Porcelain Enamel Institute. Dr. Smith has been conducting technical research projects for the Institute since his original appointment in August 1937. For the last year he has been working on a test for impact resistance in enamels and more recently has been developing a standard test of chip resistance of porcelain enamels.

C. Hascal Bliss, vice president, Nash-Kelvinator Corp., Kenosha, Wisc., has resigned.

William C. Arthur has been appointed president of Talon, Inc., Meadville, Pa., succeeding *Wallace D. Walker*, who died recently. Mr. Arthur has been an official of the company since 1927 and vice-president and a director since 1937. *S. M. Kinney*, formerly sales manager, has been appointed vice-president and *P. K. Poulton*, formerly treasurer, has been appointed secretary-treasurer.

W. C. Treadwell, for several years New England representative of Maas & Waldstein Company, makers of industrial finishes, Newark, New Jersey, is now covering upper New York State for his company with headquarters at Rochester, N. Y.

Mr. Treadwell, who is a finishing engineer of wide experience, brings to users of industrial finishes in his new territory an expert knowledge of electroplating and metal finishing in all their phases.



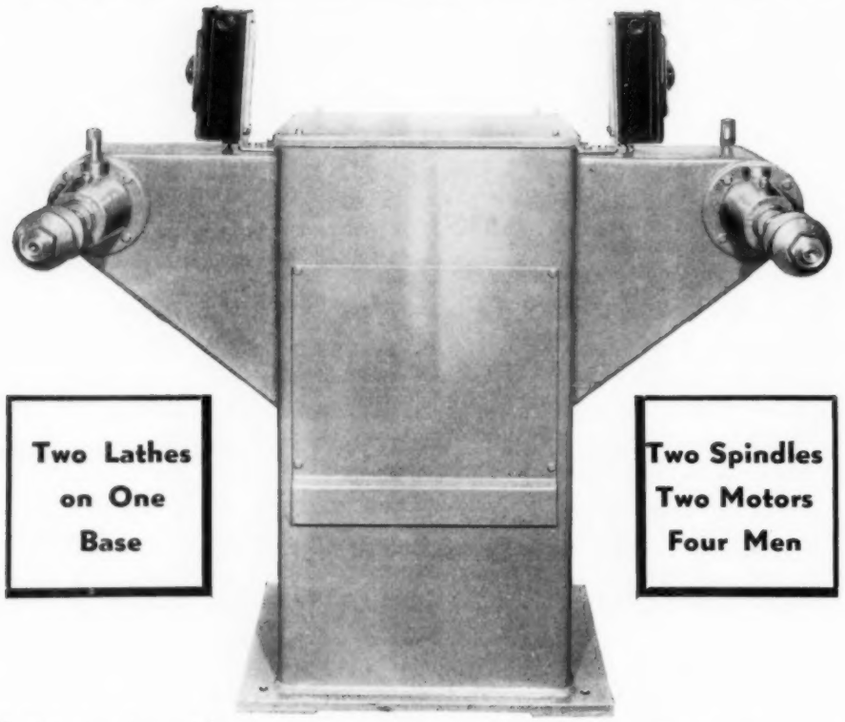
SIMPLIFY YOUR PLATING OPERATIONS

Eliminate trouble resulting from inferior anodes and solutions . . . Harshaw anodes and chemicals surpass every plating specification and produce superior finishes with minimum control.

THE HARSHAW CHEMICAL CO.

Manufacturers, Importers, Merchants
Offices and Laboratories: Cleveland, Ohio
Quality products since 1892
New York, Philadelphia, Chicago, Detroit, Pittsburgh, Cincinnati, East Liverpool, Los Angeles, San Francisco. Works at Cleveland and Elyria, Ohio and Philadelphia, Pa.

THE SPACE SAVER!


Two Lathes on One Base
Two Spindles Two Motors Four Men
Add the Second Lathe in this Floor Space
Install a Standard Single Spindle Lathe in this Floor Space

Crown Complete Plating and Polishing Equipment

Rheostat & Supply Co.

1910 Maypole Ave. **Chicago, Ill.**

Homer Britton was elected vice-president and general foundry manager of the Cleveland Co-Operative Stove Co., Cleveland, Ohio. Mr. Britton has been with the company for 26 years, having begun as general office clerk and progressing through the positions of time-keeper and assistant foundry manager.

Harry Ebright has joined the staff of the Chicago Vitreous Enamel Product Co., Cicero, Ill. Mr. Ebright has been associated with the porcelain enameling industry for almost twenty years and has had a wide range of experience in connection with enamel manufacture and the operation of enameling plants. He earned his degree in ceramic engineering at Ohio State University in 1922 and since that time has held sales, service and executive positions in the enameling industry.

Elmer Ward has joined the Technical Sales Division of the Quaker Chemical Products Corp., Conshohocken, Pa. Mr. Ward is an expert cutting oil technician, having been closely associated with their development and application for 25 years. He has established headquarters in Dayton, Ohio, and is servicing the trade in Western Ohio and Eastern Indiana.

Frederick R. Slagle, general manager of the Rolling Mill Division of the Miller Co., Meriden, Conn., has been elected a vice-president of the company at a recent meeting of the directors. Mr. Slagle joined the Miller organization as foreman of the rolling mill in 1928, coming from the Bridgeport Brass Co., Bridgeport, Conn. From foreman he advanced to superintendent and from superintendent to general manager. Mr. Slagle has devoted the greater part of his life to the metal working industry.

Keith C. Bowers, formerly of the St. Louis office, Revere Copper & Brass, Inc., has been appointed sales representative in western Missouri and Kansas, residing in Kansas City, Mo.

Verified Business Items

Nelson H. Norris, formerly with the Veeder-Root, Inc., Hartford, Conn., has been appointed general manager of the Marathon Steel Specialties Corp., Marathon, N. Y. Mr. Norris, while with Veeder-Root, Inc., installed their wage payment system. He also designed and installed their assembly lines and methods for the assembly of the Veeder gasoline computer. The last year he was in charge of the manufacture of tools for this company. Prior to his connection with Veeder-Root, Inc., Mr. Norris was with the Western Electric Co., Kearny, N. J., and wrote several papers on manufacturing and one was given before the American Chemical Society Rubber Division on Plating. The Marathon Steel Specialties Corp., operate the following departments: pickling, stamping, soldering, welding, grinding, descaling, degreasing, cleaning, plating, buffing, coloring, lacquering, finishing.

McKenna Metals Co., Latrobe, Pa., manufacturers of Kennametal tools and blanks for steel and metal cutting, has opened a branch office in Detroit in charge of *Elwin M. Strickland*, 142 Lothrop Bldg., 7376 Grand River Ave. For many years, Mr. Strickland was a diamond tool manufacturer in Detroit. He will be in charge of selling Kennametal blanks to tool makers.

L. B. McCully, former superintendent of the generator division, Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa., has been appointed manager of the recently combined transportation and generator divisions. He succeeds *F. H. Stohr* who was appointed manager of the company's industry sales department. The following departments are operated: rolling, welding, grinding. Principal base metal used: steel.

Carl A. Ostling, former head of the Pontiac Div., General Motors Corp., Detroit, has been appointed vice-president in charge of production at the Syracuse, N. Y., plant of the Carrier Corp. He succeeds *L. R. Bulware*, who resigned recently. The following departments are operated: pickling, stamping, soldering, brazing, welding, grinding, sand-blasting, polishing, cleaning, finishing, galvanizing and tinning. Principal base metals used: brass, steel, bronze.

C. S. Swayze, former superintendent of the Anderson, Ind., plant of the Delco-Remy Div., General Motors Corp., Detroit, has been appointed general manager of the corporation's Delco Radio Div. plant in Kokomo, Ind. He succeeds *Ray Ellis*, who is now Delco Radio sales manager. The company operates the following departments: drawing, extruding, stamping, soldering, welding, polishing, degreasing, cleaning, plating, tumbling, buffing, lacquering, enameling. Principal bases metals used: brass and steel.

Air Conditioning Engineering Co., 61 Rogers St., Boston, Mass., has leased a floor in building at 100 Charles River Rd., for manufacturing plant. This firm operates a sheet metal working department.

Rumford Chemical Works, Rumford, R. I. who this year celebrate their 80th anniversary of their baking powder business, have opened a new plant for the manufacture of sodium tetraphosphate. The plant is reported to be the only one in this country for the manufacture of this chemical which has the ability to segregate calcium compounds when they are present in water, and hence, it is used for water softening. In addition, other uses have been developed which include dish washing preparations, cleaning compounds and oil well drilling.

Detroit Rex Products Co., 13005 Hillview Ave., Detroit, Mich., has expanded their sheet metal manufacturing division so as to include certain production phases of finishing as well as metal cleaning. *I. J. Belanger*, formerly of the Belanger Fan & Oven Co., Detroit, has been appointed manager of this division. Included under this division are the manufacturing, marketing, installation and servicing of industrial oven equipment, Bonderite and other rust proofing systems, alkali washers and stripping machines, and general sheet metal work such as tankage, bins, etc. This division will also have supervision of spray booth installations.

Coudes Detergent Co., 7016 Euclid Ave., Cleveland, Ohio, has announced the organization of a metal cleaning department which will solicit business directly from the metal working plants about the country. *Harold L. Trembicki* will become manager of this department. Mr. Trembicki was born in London, England, and went to school at the University of Warsaw in Poland while his father was an American Consul. He was in foreign sales work with the Crucible Steel Company from 1913 to 1920 and with Oakite Products, Inc., as divisional sales manager from 1920 to 1933. He was president of the Ultrex Chemical Products Co. from 1933 to 1938.

The Stanley Chemical Co., East Berlin, Conn., announces the appointment of *Evert D. Cobb* as a direct factory representative in the state of Ohio. In order to most effectively cooperate with manufacturers on their industrial coating problems, Mr. Cobb received several months of intensive training at East Berlin before going into his territory.

Jamestown Metal Equipment Co., Jamestown, N. Y., manufacturer of automobile radiators, etc., has let general contract for one-story addition, 78 x 220 ft. Cost over $75,000 with equipment. The following departments are operated: drawing, pickling, stamping, soldering, brazing, welding, grinding, polishing, cleaning, buffing, enameling and tinning. Principal base metals used: brass and steel.

Pratt & Whitney Div., Niles-Bement-Pond Co., Hartford, Conn., plans new one-story plant on 120-acre tract at West Hartford, consisting of a main one-story unit, totalling about 700,000 sq. ft. of floor space, and two-story office structure. Present works will be removed to new location and increased capacity carried out.

INTER-OFFICE MEMO

TO A.S.

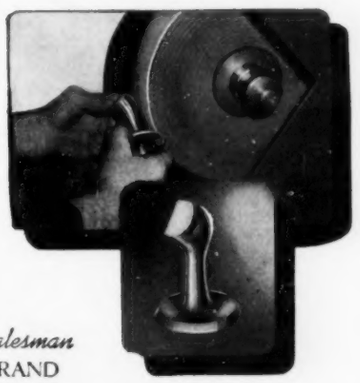
FROM J.W.

SUBJECT Pre-finished Metals

I wonder if we're not overlooking a good bet? I understand pre-finished metals are now being used for practically all types of products and manufacturing operations. Why can't we use them, too? They mean the complete elimination of plating and polishing operations - and that means plenty of production savings for us! Please write to the AMERICAN NICKELOID COMPANY, 8 Second Street, Peru, Illinois for their free booklet that tells the whole story and shows how others are using the metals. Bring it in when it comes and we'll go over it together.

FELT DOES IT BETTER

What a difference in your finished product when you use *Paramount Felt Polishing Wheels* for grease polishing—that all-important finish that swings the buyer's decision to your product.



Ask your supplies salesman for PARAMOUNT BRAND

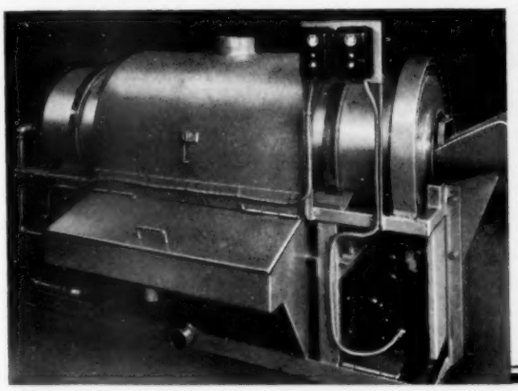
Bacon Felt Co.

WINCHESTER MASS · ESTABLISHED SINCE 1824

IDEAL TRADE MARK REG. U.S. PAT OFF.

NEW LOW-COST DRUM-TYPE METAL-CLEANING MACHINE

for Small Stampings and Screw Machine Work



This low cost machine, designed especially to wash and clean small work faster, cuts overhead costs and does a better production job.

N. Ransohoff, Inc. are pioneers in the manufacture of metal-cleaning, washing, sawdust tumbling, burnishing, and separating machines. Custom built machines to meet your individual requirements. Write today.

Put your cleaning problems up to Specialists.

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STAINLESS STEEL POLISHING COMPOUNDS

If It's Stainless Steel Polishing It's a "4-A" Job

It's been proved every day in every kind of metal working plant: "4-A" Polishing Compounds are faster, more efficient and more economical for cutting down, polishing and mirror finishing all kinds of steel, including stainless and radium.

Use it with any kind of wheel—soft, medium or hard—and the results will speak more eloquently than anything we could say.

Tell us about your toughest job, and we'll be glad to send the "4-A" product that will solve your problem No obligation, of course

Instead of glue, use "4-A" Cement and Thinner, a uniform substitute for polishing Wheels, Belts, Buffs, Rolls, etc Samples of Compound or Cement sent on request.

CEMENT AND THINNER

HARRISON & COMPANY HAVERHILL, MASS.

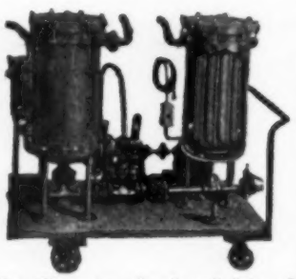
TRADE MARK
MATCHLESS
REG. U.S. PAT. OFF.

JUNK IS WEALTH

To the man who is in the junk business, but—
YOU DO NOT SELL JUNK
Therefore you should not buy junk
Buying on price alone is a gamble
BE SURE OF MAKING A PROFIT
USE ONLY
MATCHLESS HIGH GRADE POLISHING WHEELS, BUFFS AND BUFFING COMPOSITIONS
There is no substitute for "MATCHLESS"

The Matchless Metal Polish Co.
840 W. 49th Pl., Chicago, Ill. 726 Bloomfield Ave., Glen Ridge, N. J.

FILTERS FOR ELECTROPLATING SOLUTIONS
AVAILABLE IN FIFTEEN TYPES AND SIZES



Cut illustrates closed and internal view of filter.

CAPACITIES: 200 to 2400 gallons per hour.

A TYPE AND SIZE FOR YOUR EXACT REQUIREMENT.

WRITE for our NEW BULLETIN giving complete specifications, recommendations, and prices on FILTERS for NICKEL or BRIGHT NICKEL, ROCHELLE COPPER, STANNATE TIN, DUPONT COPPER, BRITE ZINC, CADMIUM, CYANIDE BRASS, COPPER, SILVER, ETC.

Also ask for information on filters and chemicals for clarifying various solvents used in degreasing units, oleum spirits, naptha, etc.

INDUSTRIAL FILTER & PUMP MFG. CO.
3017 W. Carroll Ave. Chicago, Ill.

Cadmium Plated Food Containers

John L. Rice, M. D., Commissioner of Health of the City of New York, has recently called the attention of the plating industry to the danger of cadmium plating dividers and ice trays of refrigerators. Cadmium used in such containers is dissolved by acid fruit juices and other substances used in foods and the ingestion of food contaminated with cadmium has caused illness in several cases. Zinc is even more readily attacked by acids and alkalies than cadmium and should not be used for plating or coating vessels which are to contain food. Illness has been reported from the use, for example, of a galvanized pail for making lemonade.

The occasional misuse of zinc and cadmium coated vessels for foods or beverages is due in part to the misconception that inasmuch as these metals protect steel from corrosion then it is assumed that they must be resistant to chemical attack themselves. The education of the general public in regard to plated finishes must of necessity be slow and those engaged in plating or those responsible for the selection of plated coatings on finished goods should, therefore, use careful judgment in deciding the finish to be used.

Plating Products Co., 325 Mulberry St., Newark, N. J., have been appointed the N. J. distributors for *Maizo*, a product made by the Maizo Mills of Circleville, Ohio. Maizo is a platers drying material which is said to combine the following characteristics: higher absorption properties than hardwood sawdust; freedom from dust; suitable for burnishing and all drying operations, including oil absorption in place of sawdust. Carload stock is carried by the Plating Products Co., at its Newark plant.

The Institute of Electrochemistry & Metallurgy, 59-61 E. 4th St., New York City, held Open House for the purpose of acquainting the men of the industry with the aims and facilities of the school. Classes were held as usual so that the visitors might obtain a view of the men working under normal conditions. The visitors were first taken to the lecture room and then to the laboratory sections where they saw students performing experiments in the field of electro-metallurgy. Next they were shown the research portions of the laboratory and finally the metallurgical section. The trustees of the Institute carried the different groups through each portion of the school and showed the equipment at hand. Between 50 and 100 guests were present.

The principal topics discussed at a two-day conference of the Division Managers of *Oakite Products, Inc.*, New York, were on new developments and improvements in cleaning methods, materials and equipment. Two subjects of interest dealt with cleaning materials now available to resist chromic acid contamination and the elimination of water spots on plated work. Also discussed was steam cleaning of heavy machinery and equipment, floors, walls and other plant maintenance work. Division managers present were *D. X. Clarin*, N. Y. and Northeastern Division; *J. J. Basch*, Philadelphia

and Southeastern Division; *J. C. Leonard*, Chicago and Southwestern Division; *H. C. Duggan*, Detroit and Midwestern Division, and *P. A. Boeck*, West Coast Division, and the company's executives.

Armstrong Cork Company, Lancaster, Pa., announces that an agreement has been made by which Armstrong becomes the exclusive distributor in this area for the line of magnesia and other high temperature insulation materials manufactured by *Keasby and Mattison Co.*, Ambler, Pa. This move follows Armstrong's absorption of the late *John R. Livezey Co.*, which handled the distributorship of Keasby and Mattison products for many years.

Billings & Spencer Co., Hartford, Conn., has acquired the Wrench Division of the *Bemis & Call Co.*, and all the wrench products, including the Coes line, formerly produced by the Bemis & Call Co., will be produced and shipped from the Billings & Spencer Hartford plant. All future orders and all correspondence pertaining to the Bemis & Call and Coes wrenches should be sent to the Billings & Spencer Co., Hartford, Conn.

New Plant of Oriental Rouge Co., Bridgeport, Conn.

Summer Management Course

The *State University of Iowa*, Iowa City, Iowa, announces the 1939 summer management course, including special work in motion and time study, for plant managers, foremen, industrial engineers, methods and time study analysts, cost accountants and office executives. This is a special three-week course (June 12 to June 30, 1939) for people in industry, and eight-week courses for college and university instructors, and for undergraduate and graduate students (June 12 to August 4, 1939).

These courses are intended for people interested in comprehensive training in motion and time study, waste elimination, cost reduction, plant lay-out, and related subjects.

The Summer Management Course will be under the direction of *Ralph M. Barnes*. Assisting in the course will be six University instructors and lecturers and nine visiting managers and engineers from industry who will conduct forums on practical production problems.

W. W. Sly Manufacturing Co., Cleveland, Ohio, has recently appointed the *Snyder Engineering Corp.*, 2444 E. 24th St., Los Angeles, Calif., as its representative. The Snyder Engineering Corp. operates out of Los Angeles, as well as San Francisco, *E. Underhill* being located at San Francisco, 2027 Vallejo St.

Mutual-Sunset Lamp Mfg. Co., Empire State Bldg., N. Y., manufacturer of floor and table lamps, and other lighting fixtures, has completed construction of one-story plant 200 x 300 ft. in North Brunswick Township, near New Brunswick, N. J., and will install equipment at once and remove plant at 360 Furman St., Brooklyn, N. Y., to new location. Facilities will be provided for about 400 employees. The following departments are operated: pickling, spinning, soldering, brazing, welding, grinding, sand-blasting, descaling, polishing, degreasing, plating, tumbling, burnishing, buffing, coloring, anodic treatment, lacquering, enameling, finishing and galvanizing. Principal base metals used: brass and zinc.

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NEW EDITION—25% more diagrams and information—a veritable encyclopedia of good repair practice
SMOOTH-ON CEMENTS
STOPS LEAKS
SMOOTH-ON No. 1
CEMENTS IRON
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Motor Car and Boat, Home, Factory and Power Plant

THIS Handbook enables any Engineer to make countless routine and emergency repairs quickly, easily, at low cost and with assured results. By following its instructions and diagrams, you can prevent or stop fluid and pressure loss at cracks and joints in boilers, steam, air or pump cylinders, valve decks, pipe lines, condensers, feed heaters, stills, tanks, etc., seal porous spots in cast metal, tighten stripped bolts, nuts or screws, anchor parts to wood, metal or masonry—all with least effort, time loss and expense.

For over 40 years the Smooth-On Iron Cements have been used in power plant repair and construction work.

The new Handbook is up-to-date with new uses found by test and from experiences of the many Smooth-On users.

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PERMAG CLEANING COMPOUNDS

Metal jobs must be low costing as well as highly efficient to be satisfactory. Because PERMAG meets these requirements so completely is why the demand is constantly increasing.
Let Magnuson Research Service bring the solution to your hard cleaning problems. Write or 'phone us.

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28 years' experience, manufacturing, selling and servicing specialized Industrial Cleaning Compounds for every purpose. Representatives, also Warehouses in Principal Cities of U. S. from Coast to Coast.

Supply Prices, March 29, 1939

Anodes

Prices, except silver, are per lb. f.o.b., shipping point, based on purchases of 2,000 lbs. or more, and subject to changes due to fluctuating metal markets.

COPPER: Cast ..... 20⅞c. per lb.
Electrolytic, full size, 15⅞c.; cut to size 15⅞c. per lb.
Rolled oval, straight, 16⅜c.; curved .. 17⅜c. per lb.
BRASS: Cast ..... 17¾c. per lb.
ZINC: Cast ..... 10 c. per lb.

NICKEL: 90-92%, 16″ and over ..... .45 per lb.
95-97%, 16″ " " ..... .46 per lb.
99%+cast, 16″ and over, 47c.; rolled, depolarized, 16″ and over, 48c.
SILVER: Rolled silver anodes .999 fine were quoted Feb. 1, from 46c. per Troy ounce upward, depending on quantity.

Chemicals

These are manufacturers' quantity prices and based on delivery from New York City.

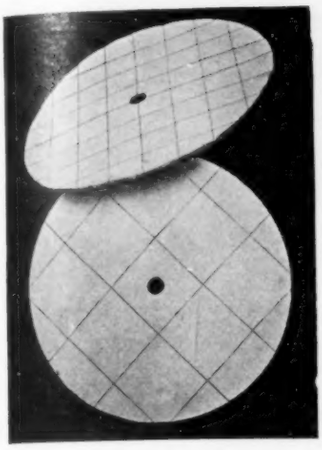
Acetone, C.P. l.c.l., drums	lb.	.06¼
Acid, Boric (boracic) granular, 99.5%, bbls.	lb.	.053-.059
Chromic, 99%, 100 lb. and 400 lb. drums	lb.	.16¾-.17¼
Hydrochloric (muriatic) Tech., 20°, carboys	lb.	.027
Hydrochloric, C.P., 20°, carboys	lb.	.08
Hydrofluoric, 30%, bbls.	lb.	.07-.08
Nitric, 36°, carboys	lb.	.06
Nitric, 42°, carboys	lb.	.075
Oleic (Red Oil), distilled, drums	lb.	.08⅜
Oxalic, bbls. l.c.l.	lb.	.12-.14
Stearic, double pressed, distilled, bags	lb.	.10½-.11½
single pressed, bags	lb.	.10-.11
triple pressed bags	lb.	.13½-.14½
Sulphuric, 66°, carboys	lb.	.025
Alcohol, Amyl, l.c.l., drums	lb.	.14
Butyl-normal, l.c.l., drums	lb.	.095
Denatured, S.D. No. 1, 190 pf., bbls., works	gal.	.32
Diacetone, pure, drums, l.c.l.	lb.	.095
Methyl, (Methanol), 95%, drums, l.c.l.	gal.	.385
Propyl-Iso, 99%, l.c.l., drums	gal.	.41
Propyl-Normal, drums	gal.	.70
Alum, ammonia, granular, bbls., works	lb.	.0315
Potash, granular, bbls., works	lb.	.034-.037
Ammonia, aqua, 26°, drums, carboys	lb.	.02¼-.05¼
Ammonium, chloride (sal-ammoniac), white, granular, bbls.	lb.	.05-.075
Sulphate, tech., bbls.	lb.	.035-.05
Sulphocyanide (thiocyanate), pure, crystal, kegs	lb.	.55-.58
Sulphocyanide (thiocyanate), com'l, drums	lb.	.16
Antimony Chloride (butter of antimony), sol., carboys	lb.	.13-.153
Barium Carbonate, ppted., l.c.l., bags, works	lb.	.03
Benzene (Benzol), pure, drums	gal.	.21
Butyl Lactate, drums	lb.	.225
Cadmium Oxide, l.c.l., bbls	lb.	.80
Calcium Carbonate (Ppted. chalk), U.S.P.	lb.	.05¾-.075
Carbon Bisulfide, l.c.l., 55 gal. drums	lb.	.05¾-.06
Carbon Tetrachloride, l.c.l., drums	gal.	.73
Chrome, green, commercial, bbls.	lb.	.22
Chromic Sulphate, drums	lb.	.26¼
Cobalt Sulphate, drums	lb.	.59
*Copper, Acetate (verdigris), bbls.	lb.	.25
Carbonate, 53/55%, bbls.	lb.	.155-.165
Cyanide, Tech., 100 lb. bbls.	lb.	.34
Sulphate, Tech., crystals, bbls.	lb.	.05
Cream of Tartar (potassium bitartrate), crystals, kegs	lb.	.20¼
Crocus Martis (iron oxide) red, tech., kegs	lb.	.07
Dibutyl Phthalate, l.c.l., drums	lb.	.195
Diethylene Glycol, l.c.l., drums, works	lb.	.17
Dextrine, yellow, kegs	lb.	.05-.08
Emery Flour (Turkish)	lb.	.07
Ethyl Acetate, 85%, l.c.l., drums	lb.	.066
Ethylene Glycol, l.c.l., drums, works	lb.	.17-.20
Flint, powdered	ton	30.00
Fluorspar No. 1 ground, 97-98%.	ton	$60.00
Fusel Oil, refined, drums	lb.	.125-.14
*Gold, Chloride	oz.	$18¼-23
Cyanide, potassium 41%	oz.	$15.45
Cyanide, sodium 46%	oz.	$17.10

*Subject to fluctuations in metal prices.

Gum, Arabic, white, powder, bbls.	lb.	.125-.14
Sandarac, prime, bags	lb.	.50
Hydrogen Peroxide, 100 volume, carboys	lb.	.20
Iron Sulphate (Copperas), bbls.	lb.	.016
Lead, Acetate (Sugar of Lead), bbls.	lb.	.10-.12¾
Oxide (Litharge), bbls.	lb.	.125
Magnesium Sulphate (Epsom Salts), tech., bag	lb.	.018
Mercury Bichloride (Corrosive Sublimate)	lb.	$1.58
Mercuric Oxide, red, powder, drums	lb.	$1.71
Nickel, Carbonate, dry, bbls.	lb.	.36-.41
Chloride, bbls.	lb.	.18-.22
Salts, single, 425 lb. bbls.	lb.	.135-.145
Salts, double, 425 lb. bbls.	lb.	.135-.145
Paraffin	lb.	.05-.06
Phosphorus, red	lb.	.40-.44
yellow	lb.	.20
Potash, Caustic, 88-92%, flake, drums, works	lb.	.07¼-.075
Potassium, Bichromate, crystals, casks	lb.	.09¼
Carbonate (potash) 98-100%, drums	lb.	.06¾
Cyanide, 94-96%, cases	lb.	.525
Pumice, ground, bbls.	lb.	.03
Quartz, powdered	ton	$30.00
Quicksilver (Mercury) 76 lb. flasks	flask	$74.-$76.50
Rochelle Salts, crystals, bbls.	lb.	19.25
Rosin, gum, bbls.	lb.	5.25-7.75
*Silver, Chloride, dry, 100 oz. lots	oz.	.40¼
Cyanide, 100 oz. lots	oz.	.39⅜
Nitrate, 100 oz. lots	oz.	.35
Sodium Carbonate (soda ash), 58%, bbls.	lb.	.0235
Cyanide 96%, 100 lb. drums	lb.	.15
Hydroxide (caustic soda) 76%, flake	lb.	.0355
Hyposulphite, crystals, bbls.	lb.	.035-.065
Metasilicate, granular, bbls.	lb.	.0315
Nitrate, tech., bbls.	lb.	.029
Phosphate, tribasic, tech., bbls.	lb.	.03
Pyrophosphate, anhydrous, bbls., l.c.l.	lb.	.0355
Sesquisilicate, drums	lb.	.0405
*Stannate, drums	lb.	.31½-.33½
Sulphate (Glauber's Salts), crystals, bbls., works	lb.	.0135
Sulphocyanide, drums	lb.	.30-.35
Sulphur, Flowers, bbls., works	lb.	.037-.0410
*Tin Chloride, 100 lb. kegs	lb.	.37
Toluene (Toluol), pure, drums, works	gal.	.27
Tripoli, powdered	lb.	.03
Wax, Bees, white, bleached, slabs 500 lbs.	lb.	.35-.36
Bees, yellow, crude	lb.	.21-.215
Carnauba, refined, bags	lb.	.34-.35
Montan, bags	lb.	.115-.12
Spermaceti, blocks	lb.	.23
Whiting, Bolted	lb.	.025-.06
Xylene (Xylol), drums, works	gal.	.31
Zinc, carbonate, bbls.	lb.	.14-.15
Cyanide, 100 lb. kegs	lb.	.33
Chloride, granular, drums	lb.	.06
Sulphate, crystals, bbls.	lb.	.04

Metal prices on page 204.

Try a Yerges Buff



Try a Yerges Buff on any job in your shop, from the hardest cutting to the softest buffing. Let us send samples and data.

SEE how this buff of exclusive design and construction cuts your cost and speeds your work. Experience of users—leaders in many industries—shows that Yerges buffs pay consistent dividends in production cost savings. Bias-cut, square-stitched, the Yerges buff presents an absolutely uniform density of face to the work throughout its entire diameter. Holds and saves the abrasive. Assembled and stitched in a wide variety of forms. The Yerges Mfg. Company, Fremont, Ohio.

YERGES

CONTROL SETS

FOR ELECTROPLATING SOLUTIONS

Sets for Chromium, Nickel, Copper, Brass, etc.

KOCOUR CO.

4720 S. Christiana Ave., Chicago

Pioneers in Testing Sets for Platers

PYRO THE IMPROVED IMMERSION PYROMETER

WILL PAY for itself QUICKLY!

BECAUSE it absolutely eliminates guesswork, waste and spoilage.

BECAUSE it is simple to use, rugged in construction, absolutely accurate and dependable. Developed FOR FOUNDRY USE; Foundrymen swear by it. PYRO embodies advanced features not found in any other pyrometer.

Write for illustrated bulletin No. 110

The Pyrometer Instrument Co.

109 Lafayette St., New York, N. Y.

APPLAUD METSO'S NON-TARNISHING EFFICIENCY

Metso Cleaner's gentle effect on soft metals reduces rejects of parts formerly tarnished. For instance, brass parts joined by a 50% tin solder were electro-cleaned by a 50% lead-without tarnishing or blackening of the solder.

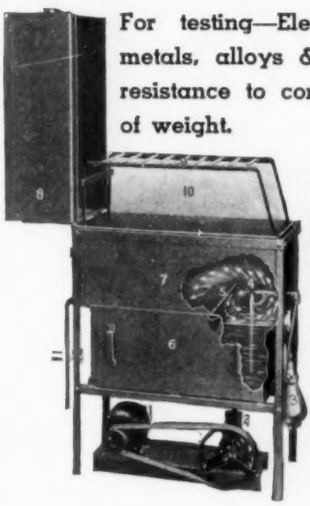
The properly balanced ingredients (alkali-silica) in Metso insure effective cleaning with a wider margin of safety. Electroplaters working with soft metals are invited to send for a two pound trial package.

METSO CLEANERS

PHILADELPHIA QUARTZ COMPANY

General Offices and Laboratory: 125 S. Third St., Phila., Pa.
Chicago Sales Office: 205 W. Wacker Drive. Stocks in 60 cities.
Sold in Canada by NATIONAL SILICATES LTD., Toronto, Ont.

SALT SPRAY TESTING EQUIPMENT



For testing—Electroplated & coated metals, alloys & Paints to determine resistance to corrosion, pitting & loss of weight.

The U. S. Bureau of Standards recommends Salt Spray test for this type of examination.

Units are made in two Standard Sizes — Test cabinets measuring — 23" high x 12" wide x 26" long & 29" high x 14" wide x 33" long.

A test of just a few hours in Salt Spray compares with many months test in the open. Effect big savings by testing different plating on production parts.

INDUSTRIAL FILTER & PUMP MFG. CO.

3017 W. Carroll Ave. Chicago, Ill.

Metal Prices, March 29, 1939

(All quotations are based on wholesale quantities, prompt delivery, New York unless otherwise specified.)

New Metals

ALUMINUM, Virgin ingot, 99% plus, c.l.	20.00c.
ANTIMONY, Chinese, 99%	14.00c.
BISMUTH, Ton lots, American, 99½%	$1.05
CADMIUM, Sticks and bars, tons	.55c.
COPPER, Lake, delivered Conn.	11.375c.
Electrolytic, delivered Conn.	11.25c.
Castings, F.O.B. refinery	10.375c.
GOLD, U. S. Treasury price, oz. Troy	$35.00
LEAD, Desilvered and Prime Western	4.70c.
MAGNESIUM, 99.95% ingot	32.00c.
MERCURY (Quicksilver), Flasks, 75 lb.	$90.50
NICKEL, Ingot or Shot	36.00c.
Electrolytic, 99.95%, sheets	35.00c.
PLATINUM, oz., Troy	$35.00
TIN, Straits	46.60c.
ZINC, Prime Western	4.50c.
Brass Special	4.60c.
High Grade	5.50c.
Die Casting Alloy	7.50c.

Ingot Metals and Alloys

	Cents per lb.
No. 1 Yellow Brass	8.875
85-5-5-5	11.00
88-10-2	14.50
80-10-10	12.875
Manganese Bronze (60,000 t. s. min.)	10.875
Aluminum Bronze	15.125
Monel Metal Shot or Block	28
Nickel Silver (12% Ni)	12.875
Nickel Silver (15% Ni)	15.125
No. 12 Aluminum	13.00-15.00
Manganese Copper, Grade A (30%)	22-27
Phosphor Copper, 10%	15.00
Phosphor Copper 15%	15.50
Silicon Copper, 10%	21.50
Phosphor Tin, no guarantee	50-60
Iridium Platinum, 5% (Nominal)	$36.50
Iridium Platinum, 10% (Nominal)	$38.00

Old Metals

Dealers' buying prices, wholesale quantities:	Cents per lb.
Heavy copper and wire, mixed	7.375-7.50
Light copper	7.125-7.50
Heavy yellow brass	4.75-4.875
Light brass	3.875-4.00
No. 1 composition	6.875-7.00
No. 1 composition, turnings	6.50-6.625
Heavy soft lead	4.00-4.125
Old zinc	2.25-2.50
New zinc clips	2.75-3.00
Aluminum clips (new, soft)	13.00-13.25
Scrap aluminum, cast	6.50-6.75
Aluminum borings—turnings	5.00-5.25
No. 1 pewter	25.00-26.00
Electrotype	4.375-4.50
Nickel anodes	25.00-26.00
Nickel clips, new	27.00-28.00
Monel scrap	8.00-12.50

Wrought Metals and Alloys

The following are net BASE PRICES per lb., to which must be added extras for size, shape, quantity, packing, etc., or discounts, as shown in manufacturers' lists. Basic quantities on most rolled or drawn brass and bronze items below are from 2,000 to 5,000 lbs.; on nickel silver, from 1,000 to 2,000 lbs.

Copper Material

Sheet, hot rolled	19.375c.
Bare Wire, soft, less than carload	15.375c.
Seamless Tubing	19.875c.

Nickel Silver

Sheet Metal		Wire and Rod	
10% Nickel	25.00c.	10% Nickel	28.625c.
15% Nickel	27.375c.	15% Nickel	31.875c.
18% Nickel	28.375c.	18% Nickel	34.75c.

Aluminum Sheet and Coil

Base Prices Carload Lots (F.O.B. Mill)

Aluminum Sheet, 20 gauge	35.00c.
Aluminum Coils, 20 gauge	28.00c.

Rolled Nickel Sheet and Rod

Base Prices (F.O.B. Mill)

Cold Drawn Rods	50c.	Standard Cold Rolled Sheet	49c.
Hot Rolled Rods	45c.		

Monel Metal Sheet and Rod

Base Prices (F.O.B. Mill)

Hot Rolled Rods	35c.	No. 35 Sheets	37c.
Cold Drawn Rods	40c.	Std. Cold Rolled Sheets	39c.

Silver Sheet

Rolled Sterling Silver 45c. per Troy oz. upward according to quantity.

Brass and Bronze Material

	Yellow Brass	Red Brass 80%	Comm'l. Bronze
Sheet	17.31c.	18.25c.	19.37c.
Wire	17.56c.	18.50c.	19.62c.
Rod	12.62c.	18.50c.	19.62c.
Angles, channels, open seam tubing	25.75c.	26.75c.	27.88c.
Seamless tubing	20.06c.	20.90c.	21.77c.

Tobin Bronze and Muntz Metal

Tobin Bronze Rod	19.125c.
Muntz Metal Sheet	20.50c.
Muntz Metal Rod	16.625c.

Zinc and Lead Sheet

Zinc Sheet, carload lots standard sizes and gauges, at mill, less 7% discount	9.75c.
Zinc Sheet, 1200 lb. lots (jobbers' prices)	10.75c.
Zinc Sheet, 100 lb. lots (jobbers' prices)	14.75c.
Full Lead Sheet	7.75c.
Cut Lead Sheet	8.00c.

Block Tin, Pewter and Britannia Sheet

This list applies to either block tin or No. 1 Britannia Metal Sheet, No. 23 B. & S. Gauge, 18 inches wide or less; prices are all f.o.b. mill:

500 lbs. over	15c. above N. Y. pig tin price
100 to 500 lbs.	17c. above N. Y. pig tin price
Up to 100 lbs.	25c. above N. Y. pig tin price

Supply prices on page 202.